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A Survey of Localization Systems in the Sea Based on New Categories

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Abstract. Localization schemes are considered very important issue for wireless networks. Today, positioning information takes big space from current research or study. In other words, localization approaches are one of the most significant works which support the creation of new innovations, services, applications and business models in the area of the most system or networks. Different methods, wireless technologies and systems were suggested in the literature to provide sea localization services to enhance the services provided to users. There is, however, a lack of an update survey paper which integrates some of the precise and accurate localization systems recently proposed. In this paper, we intend to conduct a survey of various techniques of localization in sea based on different technologies and systems that was mentioned in the literature. The paper focuses primarily on localization systems from new vision. The current systems introduced in the literature are highlighted and classified in new categories. By comparison to the current surveys, different systems are also previewed from the perspective of their technologies they used. Instead of these classifications, we are proposing a new category for the localization systems and we are also addressing remaining challenges to accurate localization.

Keywords: Localization, Global positioning system, Indoor localization, outdoor localization,

Localization techniques and technologies, Ad hoc Network.

1. Introduction

Localization is the method used to assess people's or resources ' location. The position information allows a person or a resource to access, track or control location-based protocols. Sea localization systems are built to provide information about the location of people and devices in the sea environment. Multipath errors are caused by satellite signals from the Global Positioning System GPS reflecting nearby structures like lock walls, bridges, buildings and other vessels. Multipath delays GPS signals and reduces the accuracy and reliability of the ship's location. Another factor affecting positioning and accuracy is the visibility of the GPS satellite. Interference limits the accuracy of location and may even result in a loss of GPS positioning in the hundreds of meter radius around the source of interference [1]. Some of the current surveys focus on either technology, others concentrate on its environment (indoor and outdoor) so It is useful to use the same localization techniques to define locations for Indoor as well as outdoor environments as 1) Indoor environments are complicated, 2) Interference with the signal and

reflection occur within the building 3) It is strongly dependent on the environment, such as the location of entities, human interactions, 4) indoor connectivity is undependable.

Fixed sensors or sensors based on GPS can be used for outdoor environments. GPS is the satellite-based navigation system most commonly used, offering maximum coverage. GPS has certain drawbacks such as: 1) It involves contact the line of sight between the receivers, 2) Clear sky view to operate properly is needed, 3) GPS device costs are high for certain conditions; 4) For restricted areas or high-rise buildings, GPS signals are often not accessible. The difficulty with the position technique is to evaluate the location information of all or a subset of sensor nodes, provided the spatial relationships between the nodes in pairs. Many sources, such as popular landmarks or GPS data; are the inputs to the localization system, many estimates of distances based on the received radio signal strength, angle of signal arrival or some proximity values using Radio frequency, Ultrasound frequency. Depending on such inputs, the positioning method either specifies the precise position of the unknown node (using Cartesian coordinates on the map or some longitude, latitude values) or some position area (e.g. house, conference room). [2][3].

The node location plays an important role in many areas such as routing, monitoring and surveilling, military etc. The main categorizes of localization can be known as location based localization using a GPS, proximity based localization using Infrared (IR), Bluetooth, etc., angle based localization using the received angle of signals or AOA angle of arrival, it's mostly used in Base Station's (BS), range based localization using the Received Signal Strength (RSSI) or Time of Arrival (ToA) or Time Difference of Arrival (TDoA) and distance based localization uses the method of propagating (DV-hop) or the method of propagating (DV-distance) for localization. The localization based on range and distance is classified differently, although both are similar. To determine the range Special hardware is required for range-based localization, but it is not necessary for distance-based localization. The techniques of localization could be classified into two forms: range-based approach and range-free approach. The positioning can be achieved with or without the anchor nodes [4][5][6].

There is still a need of better understanding of state-of-the-art localization technologies to inspire new research efforts in the field. This paper aims to serve for this purpose. Different localization techniques in sea based on different technologies and systems that have been proposed in the literature classified in new categories were reviewed in this paper and a new category for the localization systems is suggested.

The remaining paper is arranged as follows. Section 2 shows the Sea Localization Systems and its Categories and provides an overview of the localization problem with new suggested category. At last, the paper is concluded by Section 3.

2. Sea Localization Systems and Its Categories

A brief search on the key word 'Localization for ships' done, and some results during the years 2013 – 2019 are obtained. Thus, some of related works are discussed in this section of paper which can be classified in some categories and finally, our suggested category illustrated as shown in figure 1 below:

2.1. Researches based on Simultaneous Localization and Mapping Algorithms (SLAM)

2.1.1. Using Kalman *Filter.* J. Choi and H.-T. Choi in [7] present an acoustic source *localization* system *for autonomous underwater vehicle navigation.*
The approach suggested is based on the time delay of two hydrophones receiving acoustic signals. Localization of the acoustic source is achieved by gathering direction information from different positions of the vehicle. The location of the acoustic source is recursively calculated using extended Kalman filter. The approach proposed can also provide a realistic estimate of the path. from the estimated time delay by using a Bayesian update process. and location of the acoustic source, even under for a noisy acoustic signal. Experimental results demonstrate the performance of the proposed acoustic source localization method in a real sea environment. Y. Lee, J. Choi, and H.-T. Choi in [8] propose an algorithm for underwater localization using imaging sonar artificial landmarks. It is arranged as follows;

1) artificial object recognition 2) A look at the localization EKF (Extended Kalman Filter) SLAM. This acquires the distance and bearing of the known artificial landmarks, allowing us to accomplish the position of our underwater vehicle. And then, the localization algorithm based on EKF is performed which produces an underwater robot path and a landmark location. Experiments in a basin verify the proposed location algorithm.
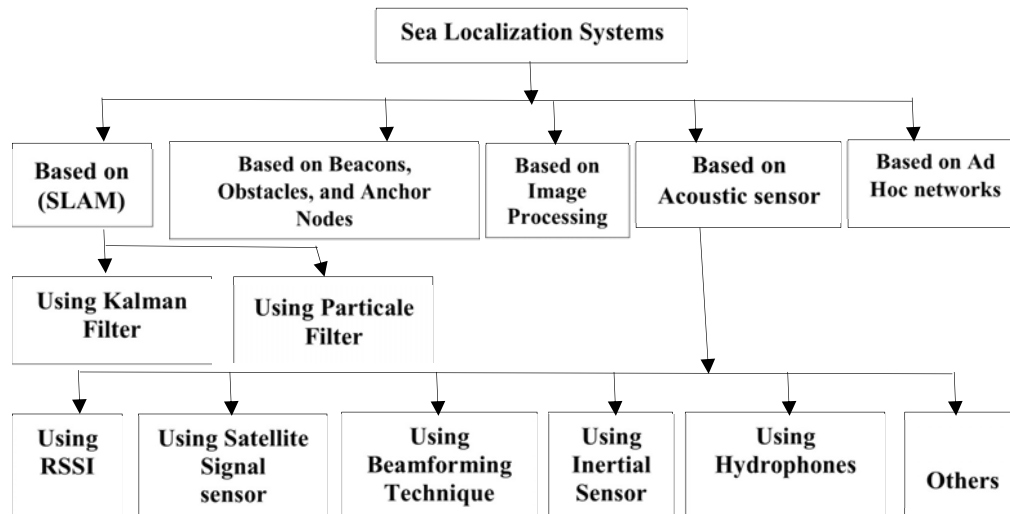

Figure 1. Categories of Sea Localization Systems.

Also Y. Lee, J. Choi, and H.-T. Choi in [9] present experimental results of a real time sonar-based localization technique using the probability based landmark-recognition method. Sonar based localization is used for the navigation of unmanned underwater vehicle (UUVs). Inertial sensors such as inertial measurement units (IMUs), Doppler Velocity Logs (DVLs), and external information obtained from sonar are combined using the Extended Kalman filter (EKF) technique to obtain the navigation information. We estimate the vehicle location using inertial sensor data, and it is corrected using sonar data, which provides the relative position between the vehicle and a landmark placed on the bottom. To verify the suitability of the proposed method, we perform experiments in a basin environment using the UUV, "yShark". An algorithm to estimate the position in AIS is suggested in [10]. The algorithm for the dual channel compensation is introduced to obtain from the different shore stations the accurate difference in signal transmission delay. Then it is possible to estimate the ship's location using the time difference of arrival (TDOA) technique. In addition, the Kalman filter is used to correct the approximation of the rough position. Eventually, in the actual AIS case, the positioning algorithm is checked and tested by the positioning test. The results show reasonable positioning accuracy. An extremely low frequency, a time-harmonic horizontal electric dipole (BED) can model the ship's Shaft-rate electric field(EF) signal in seawater. [11] Describe the EF-based localization method. At two fIXed field points provided by the dipole motion, EF was simulated as measurement data in the shallow sea. The paper introduces an efficient Kalman Filter-based localization algorithm. The emulative calculation is given to demonstrate the extremely high accuracy of the optimal localization algorithm. [12] Presents the extended kalman filter algorithm as the basis of SLAM, explains the unmanned SLAM helicopter issue, develops the movement equation and perception equation of the unmanned helicopter, checks the concept of equation decomposition of the EKF-SLAM algorithm, investigates the modified EKF-SLAM algorithm, Eventually, a simulation test to check the algorithm that can perform navigation within a certain range of errors for unmanned autonomous helicopter landing. In [13] W. Liu and et introduces a new Unmanned Surface Vehicle (USV) sensor data fusion

algorithm for autonomous navigation. with an improved UKF algorithm which capable of estimation adaptively, called the Fuzzy adaptive UKF data fusion algorithm to get accurate movement information and improve the performance of the classical Kalman Uncented Filter UKF, to allow the algorithm to verify and correct in real time the related sensor noise. The proposed algorithm was tested and evaluated using realistic maritime conditions in different simulations, and the results were compared to classical UKF. For further verification, the measurements of sensor possessed from a realistic USV experiment as well applied into suggested algorithm.

2.1.2. Using Particale Filter.

[14] Evidence of an autonomous underwater vehicle method for real-time visual simultaneous localization and mapping (SLAM) over multiple sessions on big hulls of ship. Their approach, together with a monocular camera, uses a piecewise-planar model to directly improve the surface of the ship's hull in their factor-graph frame and to co-register multiple surveys by anchor nodes. To sparsify the factor graph, they use the recent Generic Linear Constraints (GLC) framework to allow real-time execution for long-term SLAM, and describe algorithm of a particle filter reacquisition so that to relocated an underwater session automatically to build SLAM graph previously. Using their method, surveys taken days, months, and even years apart can be automatically aligned. J. Li and et al. [15] Reports on an underwater robot's real-time simultaneous localization and mapping algorithm (SLAM) using a forward-looking sonar imaging (FLS) and its use in the field of checking autonomous underwater of ship hull. This algorithm addresses certain challenges related with deliverable underwater acoustic SLAM, including sparsity feature and the correlation of false-positive data at the time of using sonar imaging. Using advanced technique for machine learning provide suggestions for saliency-conscious loop closure. further robust approach to data collection is also being established using various available constraints. Evaluation is based in a ship hull inspection framework on real-world data obtained, which demonstrates the reliability and robustness of the system.

2.2. Researches based on Acoustic sensor

2.2.1. Using Received Signal Strength Indicator RSSI.

An overboard localization system based on measurement of the received signal strength indicator (RSSI) between smart lifejacket tags and one interrogator station inside an unmanned aerial vehicle (UAV) presented in [16]. Localization is based on the algorithm of weighted minimum mean squares (LMS). Simulations are presented and it reveals that, relative to other search paths the parallel track search path gives better position performance. The results of the evaluation show better accuracy of location compared to other localization algorithms based on RSSI. In [17] a novel approach, called spatio-temporal fingerprint localization, is proposed. This approach can alleviate the impact of the dynamic shipboard environment and enhance the localization robustness. In order to filter irrelevant noise from position fingerprints, a radio time series is suggested. Using linear discriminant analysis and principal component analysis, an extraction method called radio spatial features is proposed to determine the highly location-related features from redundant RSSI data. The proposed algorithm gives better accuracy than previous methods based on fingerprints. C. Liu and et al in [18] propose a novel localization algorithm based on virtual node assistance underwater acoustic sensor networks. The algorithm is categorized into two parts, including the Virtual Node Assisted Static Localization (VAS) algorithm and the Virtual Node Assisted Dynamic Localization (VAD) algorithm. For virtual node configuration, error calculation, and range of RSSI, an auxiliary node is deployed. The ship equipped with GPS uses virtual node and geometry to locate UASNs without complicated deployment or time synchronization procedures.

2.2.2. Using Satellite Signal.

In [19] R. Prévost and et al addresses the ship localization problem by using satellite-received and automatic identification system (AIS) communications. In general, ships that do not transmit their actual

position in AIS signals are assumed to be located. The proposed method of localization is based on the least square algorithm and uses the differences of arrival times and carrier frequencies of satellite received messages. A modification of this algorithm is proposed as additional measurements to take into account the ships ' displacement model. This adjustment shows a significant improvement in localization. Addressing the use of global satellite navigation systems as opportunistic sources in a passive multi-static radar system for joint identification and positioning of vessels at sea. Establish single receiver on a suitable platform (e.g. a moored buoy) able to capture the signals released from several navigation satellites and reflected from interesting ship targets. F. Santi and et al [20] Sets out a one-stage method to detect and locate ship targets simultaneously by using long integral times (ten seconds) and fairly leveraging the spatial diversity that configuration provides. Using the long integration time as well as the multiple transmitters will greatly improve system performance. In addition, one-stage proposed method could achieve maximum detection quality than a classical two-stage system in which environmental decisions are taken at each bistatic connection and then multilateralization methods achieve localization. Experimental results in different scenarios, taking into account various types and Galileo transmitters of potential targets. Results obtained show the effectiveness of the proposed method to identify and locate ship targets of interest.

2.2.3. Using Beamforming Technique.
The principle and simulation of a twin-line beam-forming technique is provided on the basis of a single line array based beam-forming [21]. The measurement area is gradually scanned, and then we compensate the time delay of each transducer to the same reference. If a scanned point's output of different elements reaches the maximum value, then the point is the location of the sound source. The beam-focused twin-line array technique can improve the positioning accuracy effect of the target location, as well as that the positioning accuracy is better than a single array. B. Oudompheng, B. Nicolas, and L. Lamotte suggests an Array signal-processing methods to identify and measure the spectral contributions of underwater acoustic-noise sources of moving surface ships. The acoustic-noise sources localization provided by using beamforming of moving sources. Alternatively, to estimate the noise-source contributions in this underwater application, deconvolution of the point-spread function in the beamforming is performed. A new weighting method for beamforming is being implemented. However, since beamforming for moving sources is suffering from bad resolution at low frequencies, a proposed algorithm such passive synthetic aperture array using to improve resolution successfully. The synthetic aperture algorithm increases the beamforming's localization efficiency for moving sources in these experiments. In addition, the new scaling technique provides a best approximation of the sources contribution of the effects of deconvolution [22].

2.2.4. Using Inertial Sensor. J. Choi and H.-T. Choi present the undersea localization system for autonomous underwater vehicles.
The proposed method fuses inertial sensor-based positioning with underwater acoustic sources angular measurement. Localization based on inertial sensors provides a basic approximation of the location and attitude of the vehicle using the dead reckoning method. By analyzing acoustic signals with the Bayesian update process, relative directional angles of the acoustic sources are acquired. The proposed method can provide accurate estimation of vehicle pose by acquiring reliable directional information. [23]. The [24] Paper presents a technique by which a low-cost, minimally equipped unmanned underwater vehicle (UUV) can locate itself when submerged using transiting sources of opportunity (SOOs) acoustic emissions. The technique provides a limited UUV position estimate and is intended to supplement the Inertial Navigation System (INS) on-board. Two physical processes are manipulated, the Doppler effect and the waveguide invariant, which are common to received acoustic signals from sources of opportunity, and is termed waveguide invariant / Doppler-based localization (WI-DBL). There is no requirement for the source track to exhibit the closest point of approach (CPA), nor is there a requirement of prior knowledge of source frequencies or maneuvering of the receiver.

2.2.5. Using Hydrophones.

In [25] K. A. U. Menon and et al. Propose an inexpensive alert system architecture which could be introduced on board fishing vessels to alarm the staff of the ship of the oncoming vessels. the underwater passive acoustics concept used to develop a more robust and user-friendly hydrophone-based system to locate nearby ships. This paper explores a new algorithm dependent upon arrival time difference and cosine law that addresses the quadrant error and quadratic root uncertainty. Also presented is the simulation result of the algorithm. Acoustic released from ships transiting littoral waterways measured by monocular hydrophone, could be used to calculate the time-varying range of source-receiver and the position of the receiver together [26]. Two peak likelihood estimators based on parameter search be introduced: one for β, the invariant parameter of the waveguide, and another for the source field. β Characterizes the intrinsic interference structure of the ducted acoustic propagation and is fundamental to the spectral analysis of the distance estimation. The reference range approach expands the authors ' prior work and focuses on the high narrowband tonals usually dominating cargo ships ' acoustic spectra. A technique is also proposed to estimate a receiver's location, which can be static or moving. The technique of localization needs realization about the origin track hydrophone information and a premier guess of the location of the receiver. A particular scenario is analyzed using data from SWellEx-96 in which the proposed technique reduces an initial location error of 3 km to less than 1 km.

2.2.6. Others.

A locating system is described for passengers on ships and in the sea when passengers were identified going overboard. Considerations of the system are carried out taking into account factors like frequencies of oscillation and modulation. The baseband architecture is debated at a reasonable update time as regard with the substantial design tradeoffs to locate a big number of various passengers. In 0.18 μm BiCMOS technology, a cross-coupled oscillator is implemented and optimized as a reflector tag for the application. The circuit generates an output power of 5 mW at 36 mW dc that rising efficiency of 14% in continuous mode, according to measurements. [27].

G. V Krishnakumar and et al. Investigate the use of a method to speculate the tendency of range between source and receiver based on multi-path time delays. In theory speculated time delays were used to evaluate the utility / limitations of this approach. In order to measure time delays between the frontal path and the reflected direction, the radiated noise signature of the surface ship was subjected to cepstral analysis. Between source and receiver estimating the slant range, the time slowness thus obtained were used. It was considered satisfactory to compare the measured with the estimated time delays [28]. Z. Liu and et al. have proposed a robust method of localization using the predictable subspace mode to recreate the replica vector. The approach is then further expanded with the assistance of the orthogonal projection matrix to work in the noisy presence area. The general benchmark mismatch model used to validate the approach proposed. Better performance results of proposed method than the mean model matched field processor (MFP) at the time of existence of loud interference in an unpredictable area. [29]. A hybrid ocean sensor network called Drifting Restricted Ocean Sensor Networks (DR-OSNs) is proposed for long-term marine monitoring activities, incorporating jointly the advantages of Wireless Sensor Networks (WSNs) and UWA-SNs, And the presence of specified underwater anchor nodes is not necessary. The entire process of localization has three stages with algorithms, Self-Moored Node Localization (SML), USD, and Floating Node Localization Algorithm (FLA). Authors perform detailed simulations to test the scheme, showing high localization accuracy achieved by LDSN and is an active localization scheme for DR-OSNs [30]. To improve the performance of a multi-input multi-output over - the-horizon radar (MIMO-OTHR) network also to reduce the lingering effect of SDC, a new multi-mode SDC spatial separation approach is proposed here [31]. In addition, the method used by authors provide assessment of the elevation angle of direction of departure (DOD) and direction of arrival (DOA), participate in mode localization. The cost function of single-mode element analysis is organized under a least square criterion by applying the bi-orthogonality of matrices. The results of simulation show the superior implementation of the proposed method, which is helpful to enhance MIMO-OTHR's ability to find out slow ships and define the mode of propagation.

2.3. Researches based on Image Processing

N. Yokoya and A. Iwasaki [32] A new object localization method called sparse representation-based object localization (SROL), based on a generalized Hough-transform-based approach using sparse parts detection representations. The proposed approach has been applied in remote sensing images to car and ship detection and its quality has been compared with that of state-of - the-art methods. Experimental results showed that using a small size of training data, the SROL algorithm could precisely locate categorical objects or a single entity. In Synthetic Aperture Radar (SAR) images, a Localized Ridgelet Transform(LRT) is presented in [33]. A localization of the ridgelet transform is the key element of this technique, in accordance with the consistency integration takes place in small windows instead of throughout the entire image. In such algorithm, the transform space is undergone to processing which server to separate and locate the reaction of linear features and put down the responses of spurious alarms. synthetic images that are corrupted by different noise levels and on actual ship wakes SAR images used together to test this algorithm. The results of this test show the robustness of the algorithm in the existence of noise and its capability to find and locate linear features that meaningfully are shorter than the size of the image. W. Li et al. present an integrated framework in which inshore ships can be automatically located and recognized in large scene satellite images. Unlike classical methods of object discrimination using two detection-classification phases, the proposed system would recognize inshore ships and types without the detection step. Taking into account ship size is a useful feature, it is proposed to use this feature with a new multimodel system. And Euclidean distance-based fusion technique is applied to merge model-driven candidates. It could essentially isolate side-by-side ships from this fusion strategy. In order to address large prospect images efficiently, to use geographic information, invariant feature transform recording is also integrated in the system. Experiments on Quickbird images demonstrate that this framework can meet the realistic requirements utilized [34]. In [35] H. Lin, Z. Shi, and Z. Zou Use the Fully Convolutionary Network (FCN) to solve the inshore ship detection problem and model a ship detection system that is more streamlined and more reliable. There are two major difficulties in solving the problem of ship detection with FCN: 1) The ships' long thin shape and arbitrary position produce objects with highly anisotropic and difficult to catch via network features and 2) Possibly Ships docked in close fitting next to each other, making it difficult to separate them. Therefore, we introduce in the network a model of task partitioning where specific tasks are allocated to layers at different depths. This approach mitigates FCN's tradeoff between precision of localization and representative feature capacity, that is essential in detecting ships that are closely docked. The experiments show that this system provides strong and dependable inshore ship detection in sophisticated situation, in addition of the benefit of FCN and the task partitioning method. Localization of Ship License Numbers (SLNs) is a significant part of smart way for water transport systems. Sadly, such subject has long been ignored [36]. An active technique is proposed to locate multi-style SLNs in scenes of nature. The issue of finding SLNs is presented as the identification of series of characters that have previous SLN characteristics. First, facing the hardness of no training data, a deep convolutionary neural network based on learning transfer is designed to find out sequences of characters in SLNs. secondly, the prior characteristics of SLNs are considered in order to locate SLNs accurately by find out the sequences of character. Three previous features of SLNs are summarized. An algorithm generating SLNs area and a fake SLN filtering algorithm based on low-level similarity are provided, respectively. At this point, the exact position is gained for the SLNs in the input image. In [37] M. Nieto-Hidalgo and et al. Using side-looking airborne radar (SLAR) images to find ships and oil spills. The approach suggested uses a two-stage structure consisting of three pairs of convolutionary neural networks (CNNs). Every pair of networks are trained to identify one class (ship, oil spill, and coast) by taking these two steps: at first network carry out a coarse detection, afterwards a specialized CNN obtains accurate position of the pixels' pertinence to each class. A post-processing phase is carried out after identification by adding a morphological opening filter to exclude small look-alikes and remove certain oil spills and ships surrounded by a minimum amount of coastline. The proposed method results provide

effective, competitive and improves previously used approaches to this task. Its still a challenging task to detect ship from optical remote sensing images because of the variety of ship sizes. To tackle this problem, X. Hou, Q. Xu, and Y. Ji [38] A size-adapted framework was proposed based on a coarse-to-fine strategy. At first, by finding the convolutionary feature maps by three superficial convolutionary neural networks (CNN) with different scales, the proposed method generates ship candidates in which all objects with arbitrary sizes are fed as input; Secondly, a fixed-length function vector is take out from the candidates by the spatial pyramid pooling (SPP) surface, irrespective of the candidates ' size and aspect ratio; Lastly, multi-task learning is used to identify candidates using a softmax classifier and to minimize ship position error by simply regressing the bounding box. The tests were performed on different images and the results showed the efficacy of the proposed method and dealing with ships of various sizes. D. Hordiiuk and et al. Provide a Convolutionary Neural Networks (CNN) method as the main algorithm / instrument for detecting vessels in various spatial resolution optical satellite images. The problem divided into stages to achieve the best results, which gave us the opportunity to control the reliability of intermediate outcomes. The two parts of the proposed method as follows: 1) building a classifier based on XSeption, 2) using the baseline Unet system with Resnet18 as an encoder for precise segmentation that enables us to achieve more than 84 percent accuracy [39]. A system is proposed that can be used to detect small maritime objects effectively. The proposed method uses aerial images in the visible spectrum as inputs to train for ship classification a categorical convolutionary neural network. The current methodology benefit with respect to former methods of object detection is such only a few images with bounding boxes of the targets to be trained for localization need to be labelled. An extended version of the MASATI dataset (MAritime SATellite Imagery) evaluated the system. The proposed approach produces better results for small targets with only 14 training images than other well-known object detection approaches, that also need extra training images [40].

2.4. Researches based on Beacons, Obstacles, and Anchor Nodes

A method using heterogeneous fleet of vehicles to move between waypoints and to develop a low cost system to ensure the AUVs underwater remain within a boundary using ranges from beacons equipped on surface vehicles is presented [41]. The inverse Two Way Parabolic Equation (2WPE) method is investigated and utilized to locate barriers (such as islands, ships and et al.) on the rough sea surface in the presence of evaporation ducts and to investigate the effectiveness and precision of the inverse 2WPE method for locating obstacles in the marine environment. [42]. In accord with such inverse algorithm, by calculating with the 1WPE and 2WPE method, the backward-field represented by obstacles is acquired at a receiving point and then reversed through the direction. Thus the reverse diffraction fields can determine the position and height of the obstacles. Simulation results for scenarios with different barriers in the sea environment were obtained by the inverse 2WPE method. The simulated data display all of the evaporation duct and rough sea surface have a notable impact on the precision rate of the location A new geometric method and derive a closed-form solution that can be implemented with a single passive sensor in Bearings Only-Target Motion Analysis BO-TMA algorithms to initiate and modify the target range. Finally, the results of evaluation and simulation showed that the proposed scheme could achieve good performance and is successful for a short time of operation, enabling an observer to travel in combat scenarios with greater flexibility. Trackers can also use the proposed algorithm to produce the initiation information and thus reduce the estimation bias [43]. Authors suggest a joint estimate of the of target sensors time and position using a single mobile anchor to minimize the cost of WSN deployment. Taking into account the anchor position suspicion, we establish a method of expectation maximization (EM) to fix the problem of joint estimation. The simulation results prove that the performance of the proposed EM model is outstanding to conventional methods such as least squares (LS), weighted least squares (WLS) and generalized total least squares (GTLS) estimators [44]. In [45] The researchers suggest an obstacle-tolerant path planning method (OTPP) to solve the problem of sensor position due to blockage. OTPP will estimate the optimal number of beacon points and track designing so that all unknown nodes are able to take in information of three locations from the MAN and minimize the number of MAN transmitted packet times. The OTPP performance is better than Z-

curves as shown in the experimental results because it decreases the total number of beacon points used and is therefore more proper in an environment present in an obstacle. OTPP can reduce localization error relative to the Z-curve and increase the coverage of localization.

2.5. Our category based on Ad Hoc networks

Global Positioning System (GPS) and Local Positioning Systems (LPS) depending on the installation of rich concentration base stations, an expensive load on most resource-constrained ad hoc wireless networks. The shortcomings of current positioning systems inspire a new network localization system that some specific nodes (anchors or beacons) define their global locations and the remainder assess their locations by calculating their local neighboring nodes ' geographic information. Alternatively, such a localization scheme for wireless multi-hop networks is defined as "cooperative," "ad-hoc," "in-network localization," or "self-localization," as network nodes assess their positions by sharing information.

3. Conclusions

In this paper, we addressed a detailed description of various techniques and technologies for sea localization. The paper also presented comprehensive survey of different sea localization systems proposed in the literature with special emphasis on some of the recent systems. The paper highlighted a number of challenges related to the sea localization and explores the current techniques for sea positioning. Researchers ' attention to the localization in the sea is a very strong significant field of research. Increasing efforts and requirement to be produced to clarify an efficient and appropriate technologies. This paper aimed at providing best perception of state of the art technologies and encouraging novel research efforts in this area. The current system of sea localization used to track objects was revised along with some further discussion to gather information and increased the ability to comprehend the specified purposes. This could serve as a starting point in this research field for further concepts and future developments.

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