The Smart Fishery System Based On Web Remote Sensing

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ABSTRACT

The fishery sector is a core part for the Indonesian economy. but the issue of climate change make a fishing expedition to be useless, because sometimes many natural phenomena that occur but are not known by the fishermen. That's why their fishery productivity are not maximal. In developed countries, maybe this problem can be solved easily. In the developed countries this problem can be solved easily. But for developing countries likes Indonesia, their traditional fishermen with limited technology can't solve that problem, So that's why we build this concept for Indonesian fishermen to help them face their limited technology. The analitical data about meeting point of the current wave of hot and cold water, the chlorophyll concentrate ,and the fish area will be maintained at back end. The system will retrieve the information based on the interaction with the user, which will be the fisherman in this case. The first part explains the definition of the smart fishery system and its benefits. Secondly we talk about another paper that have a related work with this system. The third part shows that the methodology of the smart fishery system. The fourth part shows the explanation of how fishermen use the system. Finally, we show the general description of the smart fishery system.

Keywords

Decision Support System, The Smart Fisher System, Web Information, Remote Sensing

1. INTRODUCTION

Nowadays, the fulfillment of human needs particularly in fishery is increasing according to the human population in the world. With this occurrence, the company which is engaged in fish suppliers have to work extra but within a fixed time.It makes many problem, such as, the large of amount of environment related data, and the slowness of reaction to environment change. Hence, the solution are required to solve these problems, such as the smart fishery system.

To improve management and decision making in respect of fish production and up to national scale. Given the close association of population and food production, it is possible to estimate the required protein production (fish).This project is a timely initiative that will bring together two major scientific communities with potensial benefit to many million of people.

In this paper, we want to describe a new generation of fishery system that has tremendous potential to improve decision support system. This application will be very useful to the fisherman because it can give the right direction of region where the fish are. So, the user can get a lot of fish in one go. This new and improved application is necessary to develop an innovative smart fishery system. This system is especially developed for fisherman in Indonesia with free websites that provides chlorophyll and sea surfeace temperature satellite image as source. But for the best result we can use the commercial websites that provides high quality chlorophyll and sea surface temperature satellite image as the source.

This paper is structured as follows. The second section present our related works. The third section discusses the

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methodology of smart fishery system. The fourth section shows the explanation of how fishermen use the system. The final section is closing.

2. RELATED WORKS

For the remote sensing approach, WANG Wen-yu and SHAO Quan-qin [7]from beijing university has use of remote sensing methods to examine physical oceanography.They discussed the surface sea conditions, using the indicators of SST and Chlorophyll-a that conduced to the production of Ommastrephes bartrami which is the second important fish in the North Pacific Ocean.Beside that, the paper[6] discussed by HU Solanlkli and the other have a related issues. Both methods can be very useful for the smart fishery system. But this method have one weakness. The quality of the image is not good to be used by fishermen as a reference for fish. Because there are no latitude and longitude of the fish region in the image.

John E. O'Reilly on his paper [3] stated that large data set containing coincident in situ chlorophyll and remote sensing reflectance measurement was used to evaluate the accuracy,precision, and suitability of a wide variety of ocean color chlorophyll algorithms for use by SeaWifs. The method called Maximum band ratio(MBR). This MBR is a new approach in empirical ocean color and has the potensial advantage of maintaning the highest possible satellite sensor signal : noise ratio over a 3 order-of-magnitude range in chlorophyll concentration. This algorithm will very useful for this paper. But it still not maximal for fishermen as a reference for fish.

Richard W. Reynold on his paper [4] mention that The new NOAA operational global sea surface temperature (SST)) analysis is described. The analyse use 7 days of in situ (ship and buoy) and satellite SST.These analyses are produce weeekly and daily using optimum interpolation (OI) on a 1 degree grid. The OI technique require the specification of data and analysis error statistic. These statistic are derived and show that the SST rms data error from ships are almost twice as large as the data error from buoys or satellite. This method will be very useful for increase accuracy of calculation of the target point (fish). But the weakness of this method is not able to provide position accuracy of fish exist in a region. So that would be very difficult for the fishermen to find fish.

In its development, this paper requires a method for divide some level of color that will give an option to the user when use smart fishery sytem. H.D.Cheng.X.H Jiang use homogram thresholding and region merging method to make the image segmentation[1]. That method will be very useful for this paper. But for the user it will not give sufficient information if the system just provide segmentation image.

3. METHODOLOGY

In this paper there are two methodology that will be used to make this system. First, determine the edge detection in color region of the image. Second, find the exact geographic location of the area.

3.1 Edge Detection In Color Region

From figure 1, determine the edge of each color using image segmentation process. The figure 1 is the image that is on paper of reference[7], which assumed Indonesia is in the region.

For image segmentation processing, we refer to the method used in the paper of reference [1] that is Homogram Threholding and Region Merging. Because by using the formula which he gave, The result of segmentation process can be done and the segmentation between each color has become very clear.

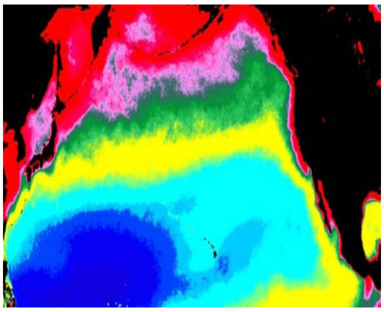

Figure 1: Chlorophyll Image based on WANG Wenyu and SHAO Quan-qin paper[7]

Smart fishery system will give five options based on color. The color is red, purple, dark green, light green and yellow. Red color is an area that has the most concentration of chlorophyll. But the region is a coastal area which has a depth so low that it is not suitable for fishermen to find fish. Purple represents areas that have a lot of chlorophyll concentration. However, in this purple area is the border between the beach with sloping sea. It is estimated that in this area there are many corals, so it will be very dangerous for the fishermen when fishing. Dark green represents areas that still have quite a lot of chlorophyll. This area is quite feasible to be the choice of fishermen in determining the catchment area. Light green is an area that has quite a lot of chlorophyll. This area became an area that is highly recommended because it also a meeting place between hot and cold currents. Yellow represents areas with little concentration of chlorophyll. But because the factors of heat and cold currents meeting, the area became a pretty good area to be selected as the place to find fish for fishermen. Blue color is not included in the option because of its location too far from shore.

3.2 Find Exact Geographic Location of The Area

To help fishermen known the fish area, we need to give the exact latitude and longitude position. Use matching found region with known map or three point methods to get the exact latitude and longitude of the fish area.

3.2.1 Matching Found Region with Known Map

The purpose of this process is to find the right position of fish region with matching the segmentation result image with known map (i.e google earth). Adopt scale-space interest point detection method from paper[2]. The method is using correlation approach with formula :

$\sum_{p\epsilon w}\left[I'\left(h\mathbf{R}\left(\chi-\mathbf{p}\right)\right)-I\left(\chi-p\right)\right]^{2}$

Where W is a window around x. Therefore, one must find a scale factor and a rotation matrix R for which the expression above is minimized. The search space associated with such a technique is very large and the associated non-linear minimization procedure has problems.

Alternatively, one may use interest points which are detected by a rotation-invariant operator and characterize these points by rotation-invariant descriptors.

Such an interest point detector was proposed in [6]. More precisely, consider an image point and the asso- ciated image greyvalue I (χ) . Interest points are detected by:

1. Compute the image derivatives in the and direc- tions,I_u, and I_ν . These computations are carried out by convolution with the differential of a Gaussian ker- nel of standard deviation σ .

2. Form the auto-correlation matrix. This matrix $C\left(\chi,\sigma,\tilde{\sigma}\right)$ averages derivatives in a window around a point χ. A Gaussian $G\left(\tilde{\sigma}\right)$ is used for weighting :

$$C\left(\chi,\sigma,\tilde{\sigma}\right)=G\left(\tilde{\sigma}\right)\star\left[\begin{array}{cc} I_u^2\left(\chi,\sigma\right) & I_uI_\nu\left(\chi,\sigma\right)\\ I_uI_\nu\left(\chi,\sigma\right) & I_\nu^2\left(\chi,\sigma\right)\end{array}\right] \quad (3)$$

3. χ is an interest point if the matrix C has two significant eigenvalues, that is if the determinant and trace of this matrix verify:

$det\left(C\right)-\alpha trace^{2}\left(C\right)>t$ (4)

where is a fixed threshold and α a parameter

Therefore, one can detect interest points at any scale by simply replacing with in eqs. (3) and (4). after the processing in the mathematic we can one equivalent. The interest point detector at scale is defined by:

$$C\left(\chi,s\sigma,s\tilde{\sigma}\right)=s^{2}G\left(s\tilde{\sigma}\right)\star\left[\begin{array}{cc} I_u^2\left(\chi,s\sigma\right) & I_uI_\nu\left(\chi,s\sigma\right)\\ I_uI_\nu\left(\chi,s\sigma\right) & I_\nu^2\left(\chi,s\sigma\right)\end{array}\right]$$

Or using the method from paper[5] to match the segmentation image with known map. Figure 2 is simple matching figure 1 with google earth using overlay feature.

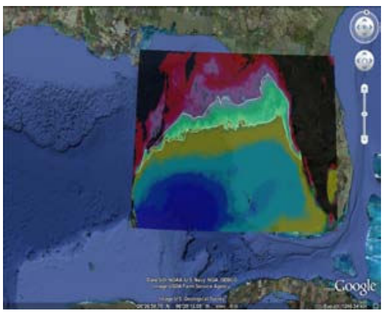

Figure 2: Overlay Result

3.2.2 *Three Point*

Assumed that the x-axis is longitude and Y-axis is latitude. Suppose that two points known and have coordinates. We will find a C point (in green/chlorophyll area) that do not have coordinates. Suppose the first point is at point A (X0, Y0) and the second point is at point B (X1.Y1). The coordinates of the C point can be known. So, it can be concluded that this method can be used as a way to determine the location.

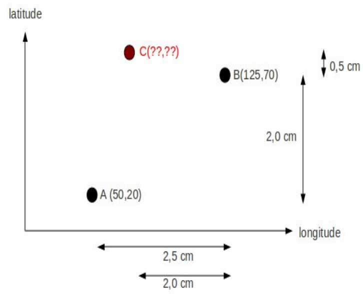

Figure 3: Three Point System

From the figure 5 that we can see: Longitude distance A to B is 75 = 2,5 cm or 1cm=30 longitude
Latitude distance A to B is 50=2cm or 1cm=25 latitude

so point C has a distance from point B 2cm in longitude and 0,5cm latitude so the position of point C (125-60,700+12,5) = (65,82,5) from the above we can calculate the X position between 2 point known

4. HOW TO USE IT

The Smart Fishery System can be used by the fishermen on land. The fishermen input their location and the application will give five option of the fish areas. The system will tell the the exact latitude and longitude position and the description of each area. Fishermen choose the fish area by analyzing the description of each area and record the latitude and longitude. Fisherman sailed using the GPS until reach the latitude and longitude location which they had noted.

5. CLOSING

In this paper, the progress that has existed until now is the smart fishery system concept design stage that using satellite imagery as data source and use the edge detection and find the exact position of fish areas, also provide the explanation of how fishermen use the system. Smart fishery system provides an effective contribution to the world with the existence of fisheries where fishermen can get maximal productivity of fish and can control the fish empowerment. For future work this concept is expected to be used for other research materials. In connection with the idea of this concept may be made a applications such as determining the route of a fisherman by providing more detailed information such as location of the rocks, wind direction, speed, etc. waves.

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