Jan. 2010, Volume 7, No.1 (Serial No.62)
Journal of Communication and Computer, ISSN 1548-7709, USA

SIDIF: Location Based Technique as a Determinant of Effectiveness and Efficiency in Artificial Reefs Development Project.

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Received: September 25, 2009 / Accepted: October 27, 2009 / Published: January 25, 2010.

Abstract: Evaluation for effectiveness and efficiency of artificial reefs (AR) development is quite difficult and troublesome. This is because of high cost incurred. As for common practice, evaluation process is done by special dive task force unit to conduct diving activity to observe on how AR has developed. The paper presents framework architecture to integrate location coordinate data (longitude and latitude) of AR with the fish catches data at all identified jetty. In SIDIF, the data of fish catches will be mapped with data on location coordinate of AR as a whole via mapping and integration of these two (2) different databases. Using this methodology, the effectiveness and efficiency of AR development will be achieved as well as the evaluation will be measured.

Key words: Spatial Information Database Integration Framework (SIDIF), Artificial Reefs (AR), fish catches, location coordinates.

1. Introduction

Malaysia Fisheries Department builds artificial reef aiming to provide natural reproduction area to marine life until commercial size is achieved. It also can protect various species of marine fish from fisherman threat which uses trawl and seine constrict. Reef's effectiveness study conducted by Fisheries Department has found that, artificial reef area is inhabited by most of marine life as compared to area outside the reef site.

The issue here was how the monitoring process is being conducted to guarantee of its effectiveness? What method will be used? Which agency is responsible for the monitoring? How the information on the effectiveness will be acquired? Due to this, this research paper will elaborate a framework to obtain an effective evaluation method of the artificial reef development by conducting artificial reef position database integration with catch yield or fish landing based on location.

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The research paper is broken up into parts such as current study problem on artificial reef effectiveness, existing system developed, proposal on design integration, its estimated revenue and conclusion.

2. Artificial Reefs Effectiveness Study

Artificial reef is a core to marine natural resources. The majority of marine species are dependable on artificial reef for food source and sanctuary. Biodiversity on artificial reef ecosystem also include million species of plants and marine life. Then the status and trend of this ecosystem are not easy to access. It is quite difficult to obtain the benefit from reef study unless a specific approach needs to be adopted.

The research on marine natural resources in Malaysia's coastal has been conducted by many scientists [1]. Most of the researches were being conducted using SCUBA method; hence information that achieved is too descriptive and limited space. There are many relevant information of marine resources in Malaysia, but because of the lacking in format and standard data, its very problematic to integrate those information for further evaluation on the status of artificial reef in the country. Thus method recommended in this program is applying hydro acoustic approach that can generate information in synoptic viewing which encompasses bathymetry of its reef and type, coverage and dispersion of marine habitat.

Artificial Reef monitoring was very useful to provide information to drive accurate and effective management actions. However, existing Artificial Reef study presented just limited to species and certain condition only [2]. Hence a complete status and trend of artificial reef ecosystem are not yet to be discovered comprehensively because of cost factor, study time and its complexity.

To overcome further destruction, immediate and continuous evaluation methodology should be initiated to get fast and right data so that the action will be taken by Artificial Reef management in Malaysia. The National Hydraulic Management Institute of Malaysia (NAHRIM) has planned a program for monitoring the artificial reef [3].

As a recap and conclusion, related information and data about artificial reef with their effectiveness must be grouped and updated.

3. ARPOS and WIFISH System

A. ARPOS System

ARPOS is software which already developed by the group of researchers lead by goodself and financing under eScienceFund research grant by Ministry of Science, Technology and Innovation (MOSTI). The ARPOS is open source software specially developed to enable all information on artificial reef are recorded, updated and retrieved through internet access.

The method on data collection and information of artificial reef development is conducted by two main farming based agencies under Ministry of Agriculture Malaysia (MOA) namely Fisheries Department (JP) and Malaysian Fisheries Development Authority (LKIM). Data on reef development is illustrated in Table 1. Information on this artificial reef is kept or recorded use bloom software electronic (spreadsheet: MS Excel). The information was about artificial reef which is recorded by LKIM party.

At the same, artificial reef information was also recorded by Fisheries Department in the same format but unavailable to store the information in a systematic database management system. Due to this, ARPOS project [4] is developed to resolve artificial reef data problem, from the normal electronics consumption pattern into a better database management system method and accessible through internet. Furthermore the software is augmented with mapping function based on location visualization that is broadcast through map geographically.

Through the software, integration problem between the two agencies can be worked out without disturbing the existing system used by the agency. The integration process of the two databases is indeed easy with ARPOS software. Both of the agencies are given authorized

password and secret code to allow all present information to be entered into new system. Once finished, the related information can be updated and processed directly. The progress of construction project also can be updated with pictorial image display as well as in video format.

Table 1: Artificial Reefs Information [5]

No	WATER AREAS OF ARTIFICIAL REEFS	LOCATION		GPS CODE	YEAR	COSTING (RM)	FUNDED BY	TYPE OF MATERIAL				
		LATITIUD	LONGITIUD					KUBOID	CYLINDER	OLD TYRE	OLD BOAT	OTHERS
57	Telaga Batin	05° 25.730'U	103° 09.024'T	TTS 01	1998	49,970.00	KWP	950				
61	Batu Buruk	05° 21.575'U	103° 13.420'T	TTS 04	2001	183,000.00	IHSAN	2,000				
62	Batu Buruk 2	05° 20.935'U	103° 12.632'T	TTS 12	2003	30,000.00	KWP	300				22 Saramik
65	Batu Buruk 3	05° 20.968'U	103° 12.562'T	TTS 13	2004	2,204,081.00	DANA KHAS					90 Saramik
.	.	.	.	.	.	.	.	.	.	.	.	. .
.	.	.	.	.	.	.	.	.	.	.	.	. .

B. WiFISH System

WiFISH is a system that was developed to facilitate data collection process on fish landing at the landing jetties [6]. Existing method used is using form manually which is filled by fisheries officer who work at landing jetties according to the prescribed schedule. Information gathered basically using the manual form.

Information on boat number, catch tool used, date, time, fish species and the volume of each species are classified according to the size whether small, medium or large. The process is conducted by observation and data is recorded into the form and later will be sent to every state headquarters, and will be pooled and further sent to Kuala Lumpur headquarters to be consolidated and published in a book with the figures of fish catches.

In the meanwhile, WiFISH is open source software developed by using wireless technology that can record landing information electronically without using form. The task of Fishery officer only will have to use cellular phone facilitates with wireless internet access to enable fish landing information be recorded.

To facilitate information on artificial reef and association position with fish landing information, then a design database integration space or SIDIF proposed to facilitate identification process artificial reef effectiveness can be valued. Information will be portrayed in mapping form based on accessible geography and map through Internet.

4. SIDIF: Database Integration

Spatial Information Databases Integration Framework or SIDIF was one design database integration space proposed to evaluate development effectiveness artificial reef. This method is was one method regarded as a new idea to ensure artificial reef development project can be valued his effectiveness.

As evaluation process previously require fairly high cost required one special scuba unit to assess artificial reef levels of development and development by diving method. SIDIF was one method combination of information of two or more database which possess different scheme and also same.

In this study, research only made integration two database only namely artificial reef database (ARPOS) and fish landing database (WiFISH). Before integration process both this database is conducted, various issues should be identified over proceed. A few process or move need to be taken broken up into 4 levels as follows [7]:

i. *Pre-integration*: Process to assess database environment are used like Oracle example, MySql, MSSQL, and MS ACESSS and from other database.
ii. *Scheme Comparison*: Scheme comparison or structure for each this database is needed to facilitate integration process conducted. In the early stage, this process is made manually.
iii. *Intermediary software development (middleware):* an application shall be developed for integration process the data base workable.
iv. *Post-Integration*: Integration process assessment was being conducted from credibility process aspect and "interoperability".

A. Three Tier Architecture

SIDIF uses architecture three layers which comprises of customer layer, application layer database waiter and layer [8]. This architecture can be applied in various forms of systems development generally. SIDIF would emphasize on service and improvement in server application layer (server tier).

1. Client Layer

This layer is an access layer by the system's user either as normal user or as system administrator. Access to web server could be achieved through internet either through wired or wireless. This layer is achieved via a user interface which required username and password as a top safety measure of system access.

2. Server Application Layer

This application layer is a very important single layer to manipulate all form of demand by the system user. Information required by customer will be entertained. Multiple applications that were developed shall be deposited in web server and as middlemen for obtaining data from database and will process the data to fulfill user demand. The layer acts as an intermediary application development (Middleware) to enable all information in various forms or format can be connected with database to suit user's requirement.

3. Database Layer

This is layer is a pretty important layer where all source of information is stored. Various types and format of databases may be linked to web server. Data in database probably will be same or might be different. Due to this, data base management system must be good and able to reduce data redundancy. The data kept in this database would be sent to web server if and only if there is a demand from user. The data will be searched by an agent who was developed through intermediary application inside a web server. All data sent to will be processed.

B. Pre-integration Processes [9]

Like those mentioned previously, process of pre integration requires a study on present database environment. ARPOS database is In MYSQL and WiFISH database in MSSQL based. The system development uses .net software which is accessible through wired internet and wireless internet. Both of the databases are owned by different agencies namely JP and LKIM and were in different location.

C. Scheme Comparison [9]

The evaluation results of the two databases are found that the location (position) of artificial reef can be equal with the location of fish catches conducted. Due to this, the location based technique is a core and a fundamental to determine the effectiveness development level of the artificial reef project development at a certain location and also within the timeline.

An equivalent assumption can be formed as follows:

Catch location (CL) is equivalent with artificial reefs development (AR). Assessment factor is dependent on catch yield number (CT) for each type of fish (FT) and comparison with artificial reef type (RT) which included. A formula can be set up here. CL ≡ AR where if found CT high ≡ FT is effective which is depending on catch date (DT) made. Vice versa if CT low, then FT to be ineffective.

Based on that assumption formula, a newly developed algorithm called location based technique can assess the effectiveness level of artificial reef development project. The integration of location based process and scheme comparison would be made by intermediary software (middleware) which shall be developed.

D. Software Development or Intermediary Application (Middleware)

Since those data in the two different databases are at different location and in different formats, then intermediary software (middleware) is very much needed for integration purposes [10]. The coding process for different database was developed using .net platform. The coding and output are shows below.

1. Get Data from MYSQL Database and output is show in Fig.1 below.

```
using System;
using System.Data;
using System.Configuration;
using System.Web;
using System.Web.Security;
using System.Web.UI;
using System.Web.UI.WebControls;
using System.Web.UI.WebControls.WebParts;
using System.Web.UI.HtmlControls;

public partial class _Default : System.Web.UI.Page
{
    protected void Page_Load(object sender, EventArgs e)
    {
//get data from Mysql database
    MysqlTableAdapters.KEDUDUKANTUKUNTableAdapter
dA = new
MysqlTableAdapters.KEDUDUKANTUKUNTableAdapter();
      Mysql.KEDUDUKANTUKUNDataTable dt1 = null;
          dt1 = dA.GetData();
          GridView1.DataSource = dt1;
          GridView1.DataBind();
```

2. Get data form MSSQL Database and output show in Fig.2 below.

```
//get data from Mssql database

mainSQLTableAdapters.PENDARATANIKANTableAdapter
dA2 = new
mainSQLTableAdapters.PENDARATANIKANTableAdapter()
;
    mainSQL.PENDARATANIKANDataTable dt2 = null;
          dt2 = dA2.GetData();
          GridView2.DataSource = dt2;
          GridView2.DataBind();
```

3. Combining two different Databases with the Location Based and output is show in Fig.3 below.

```
//combining the data

DataTable combine = new DataTable();
          combine.Columns.Add("TARIKHTANGKAPAN",
typeof(string ));
          combine.Columns.Add("JENISIKAN",
typeof(string));

combine.Columns.Add("JUMLAHHASILTANGKAPAN",
typeof(string));
          combine.Columns.Add("KAWASANTANGKAPAN",
typeof(string));
```

```
            combine.Columns.Add("JENISTUKUN",
typeof(string));

            for (int i = 0; i < dt1.Rows.Count; i++)
            {
                for (int j = 0; j < dt2.Rows.Count; j++)
                {
                    if
(dt1.Rows[i]["TAPAKUNJAM"].ToString() ==
dt2.Rows[j]["KAWASANTANGKAPAN"].ToString ())
                    {

combine.Rows.Add(dt2.Rows[j]["TARIKHPENDARATAN"].T
oString(), dt2.Rows[j]["JENISIKAN"].ToString(),
dt2.Rows[j]["JUMLAHHASILTANGKAPAN"].ToString(),
dt1.Rows[i]["TAPAKUNJAM"],
dt1.Rows[i]["JENISTUKUN"]);
                    }
                }
            }
            GridView3.DataSource= combine ;
            GridView3.DataBind();
        }
}
```

Kod Tukun	Tapak Unjam	Kedudukan Latitude	Kedudukan Longitude	Jenis Tukun	Bilangan Tukun	Tahun Dibina	Jumlah Peruntukan	Pembiaya Projek
TTS 01	PULAU BIDONG	05° 25.730'U	103° 09.024'T	KUBOID	950	1998	49,970.00	KWP
TTS02	PULAU KAPAS	05° 25.730'U	103° 09.024'T	KUBOID	1,400	1999	122,900.00	KWP
TTS 16	PULAU PERHENTIAN	05° 26.556'U	103° 09.640'T	SERAMIK	180	2003	3,430,000.00	Dana Khas

Fig.1. Output Display Based on Get Data from MYSQL Database

No Bot	Jenis Perkakasan	Tarikh Pendaratan	Masa Pendaratan	Kod Ikan	Jenis Ikan	Jumlah Hasil Tangkapan	Harga	Kawasan Tangkapan	Pusat pendaratan
TAP001	Pukat Cerut	12.12.2009	11.00	AA1	KERISI	100	2	PULAU BIDONG	KECIL
TAP001	Pukat Cerut	12.12.2009	11.00	AA2	KEMBONG	200	7	PULAU KAPAS	BESAR
TAP002	Pukat Hanyut	13.12.2009	10.00	AA1	KERISI	100	2	PULAU PERHENTIAN	KECIL
TAP002	Pukat Hanyut	13.12.2009	10.00	AA1	KERISI	150	2	PULAU BIDONG	SEDERHANA

Fig.2. Output Display Based on Get Data from MSSQL Database

Tarikh Tangkapan	Jenis Ikan	Hasil tangkapan	Lokasi Tangkapan	Jenis Tukun
12.12.2009	KERISI	100	PULAU BIDONG	KUBOID
13.12.2009	KERISI	150	PULAU BIDONG	KUBOID
12.12.2009	KEMBONG	200	PULAU KAPAS	KUBOID
13.12.2009	KERISI	100	PULAU PERHENTIAN	SERAMIK

Fig.3. Output Display Based on Combination of two databases

Result of integration in both databases obtained as in Fig.1 to Fig.3 can be analyzed directly by intermediary software and comparison will be acquired such as in bar graph as follows in Fig.4 and Fig.5, it is stated that the catch yield in February 2008 and 2009 has a condition of almost alike.

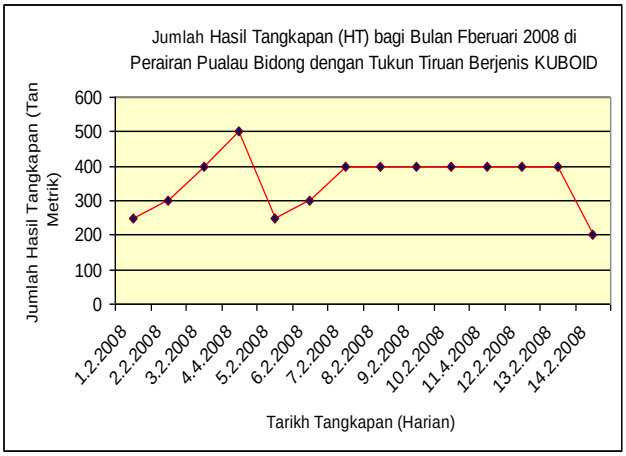

Fig.4. Graph of total of *Kerisi* Type of Fish Catches in February 2008 at Bidong Island Water Park

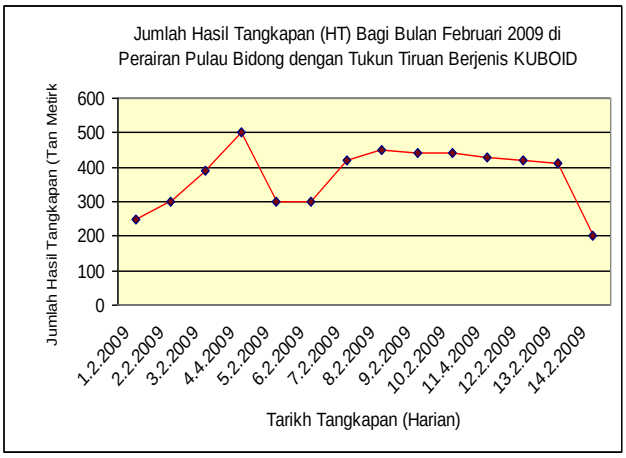

Fig.5. Graph of total of *Kerisi* Type of Fish Catches in February 2009 at Bidong Island Water Park

Conclusion may be formed that catch yield in forwarding month onwards can be made as a measurement to ensure the growth effectiveness of the artificial reef or otherwise. Due to this, future intermediary software developed would enable the integration process of those data will be carried out efficiently and faster manner and could be achieved through website only. Comparison may be made considering the result on average distribution of fish catches by monthly originated on January until December of year 2008 and also 2009. Whilst year 2010 will be a determinant on how effective the methods are.

Apart from that, effectiveness period of the developed reef also can be evaluated by analyzing artificial reef data since year 1985 until today. Effectiveness period of reefs type can be evaluated through this location based technique. Due to this, all information on the artificial reef landing distribution may be visualized via online map.

E. Post-Integration

Post-integration also will evaluate efficiency level and credibility of intermediary software (middleware) that was developed [10]. It has an ability to carry out integration process of information required by the systems user. Processing time to supply required information will be noted as well as to enable the method used might be measurable.

6. Conclusion and Discussion

SIDIF is an architecture design which can be recycled in integration problem solutions of various databases. Location based technique for determination of the artificial reef is better to obtain satisfactory decision. Due to this, if this method is successfully deployed and implemented, then the determination of effectiveness for artificial reefs development project can be valued easily without requiring high cost and can give huge impact to fishing industry in Malaysia.

Study after this would give focus to intermediary software development (middleware) and effectiveness evaluation. Apart from that, the testing of SIDIF design will be conducted for integration of more than two (2) databases or Multi Databases.

7. Acknowledgement

Appreciation conveyed to Malaysian Fisheries Development Authority (LKIM), Institut Penyelidikan Perikanan Malaysia, Fisheries Department and MOSTI for contribution of above data and information, and ARPOS project financing under eSciencesFund research grant. Last appreciation will be to researchers in this research group.

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