PROCEEDINGS

International Symposium on GeoInformatics for Spatial-Infrastructure Development in Earth and Allied Sciences

Theme: Geoinformatics For Regional Sustainable Development

Hochiminh City, Vietnam, 9-11 November 2006

Symposium Chairs: Nghiem Vu Khai, Takashi Fujita and Phan Thanh Binh
Editors: Venkatesh Raghavan and Huynh Thi Minh Hang

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Theme: Geoinformatics for Regional Sustainable Development

Editors: Venkatesh Raghavan and Huynh Thi Minh Hang

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BUILDING UP A TOOL FOR INTEGRATED COASTAL MANAGEMENT IN DA NANG CITY

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ABSTRACT

Marine and coastal areas play an important role in socio – economic development of Vietnam. In the reality revealed Vietnam coastal area is the most eventful economic developing region with series of mineral advantages, for instance, fossil coal, petroleum, gas, iron, mineral sand, and so on. However, marine environment in Vietnam is currently incurring excessive pressures, sea pollution derived from disposal sources of the mainland on the explicit tendency of increase.

To be one of the most dynamic cities of Vietnam, Da Nang possesses the fairly territorial waters with 92 km of seashore and an exclusive economic region well known all over the country on tourism sector, seaport and the dynamic in economic development. Also, similar to various provinces and cities over the country, Da Nang is encountering to several issues relating to resources and environment, in which marine and coastal environment existing. This is production operations leading to the pollution toward coastal area. For the time, several administrative branches and departments took part in carrying out Integrated Coastal Management (ICM) project for Da Nang coastal area. In addition to achieved results, the biggest shortcoming of the the project is the absence of an integrated tool based on the application foundation of GIS technology.

In this report presents the result in respect of building up informatics tool named COAST (Computer prOgrAm for coaStal managementT for Da Nang city) to support the management mission, monitoring and promptly perform the report of environment assessment on coastal area of Da Nang bay and estuary area of Cu De river, Da Nang City. The outstanding characteristic of COAST is the GIS application, environmental database and mathematical models.

1. INTRODUCTION

Danang city is situated in the coastal region of central part of Vietnam, at the medium location nationwide in geographic co-ordinate range of $15^0$55'19" to $16^0$31'20" of northern latitude, $107^0$49'11" to $108^0$20'20" of eastern longitude. The center of the city is 764 km far from Hanoi capital on the South, 964km far from Ho Chi Minh City. It was the first type urban in 2003 and Danang is vigorously changing to head to the future in the statute of a young dynamic city. Danang's strengths were shown on seaport system, sea travel, and aquatic product export. Hence, in the socio-economic strategy to 2010 of the city, sea economy has been determined as one of spearhead of Danang. Integrated coastal zone management – ICZM for Da Nang City is one of the model projects for national performance in respect of integrated coastal management.

Integrated coastal zone management (ICZM) strategy for Da Nang City has commenced the construction from December, 2000 and completed in November, 2001,

within the framework of regional project on sea environment management of PEMSEA[1] (GEF/UNDP/IMO RAS/98/G33). This is the strategy of management and reasonable usage, gathering natural resources and environment of the coastal area in the outlook of unshakable development. It will be the basis for the building up the specific and reasonable action plans for the common development of the coastal area, suitable to the interest of all branches, organizations, communities and other parties concerned. For the past 5 years, the ICZM strategy for Da Nang City has initially developed and obtained certain results. Apart from gained results, it may narrow down some shortcomings of the project as follows:

- The project scope is too large, relating to various departments and branches while such departments and branches are just responsible or having competence in connection to a certain group of information in their undertaking. Currently, the shortage of assistance tools for services, departments and branches to participate in finding out the common voice in the environment protection problem.
- In the scope of project, a mass of data has been gathered. Presently, recording, access, information sharing and making report are so difficult.
- Although database used for management goal in coastal area as well as estuary is available but uncompleted, there is no regulation on sharing information between departments, branches participating in managing coastal area yet.
- Gathered figures are not matched to the numerical map yet and caused difficulties for accessibility.
- The application of mathematical simulation model integration approach, environmental database for evaluating influences of economic activities over the environment is still limited.
- The lack of monitoring data integration tool, legal documents in line with other environmental databases to help project management task.

Thence, the imperativeness of this research project is:

- Currently, Danang VNICZM project has still not proposed an optimal management model, namely, competent services, departments and branches participating in the project have not got any tool to help them in a good cooperation and thereby building up an assistance tool is essential.
- In order to step by step integrate with region and internationality, Danang is needed to build up an infrastructure of information satisfying regional and international criteria of which the coastal information system is an integral part.

Accordingly, the goal of this research is to build up an informatics tool aiming to support management assignment, supervision and making reports in terms of evaluating environment in coastal range of Danang bay on the basis of GIS and database technology application.

2. SOME URGENT ENVIRONMENTAL ISSUES AT COASTAL AREA OF DANANG BAY

At present, water quality of Danang bay is also one of the concerning worthy issue. At Danang bay, there are 4 monitoring stations – the one lies on Phu Loc estuary and the other 3 stations near Cu De estuary, 500m, 1000, 1000m far from the estuary respectively.

According to the result of the pilot general environmental monitoring program, the seawater quality of Danang bay valued at BOD_5 lower than Vietnamese standard value but its change scope is wide (2-8mg/l). It is needed to prevent the risk of BOD_5 pollution in the future. Microorganism pollution is the problem needed to take into account, thus a method is needed to be put forward aiming to reduce living wastes and fertilizers from discharge

[1] Partnership in Environmental Management for the Seas of East Asia,

source. Though other parameters are not in excessive of stipulated standard but their changes are relatively strong, it really is needed to take into consideration.

Cu De river area under Danang bay is the sensitive ecological area due the natural aquatic system exists here, including fish and benthos freshwater, brackish water and salt water animals; artificial ecosystem includes shrimp farms, freshwater and brackish water fish farms. In addition, there is also the existence of sea grass in Cu De estuary area under direct impact of wastes from the shore discharged into the sea and corals allotted at rock banks along with the edge of Hai Van Pass' base.

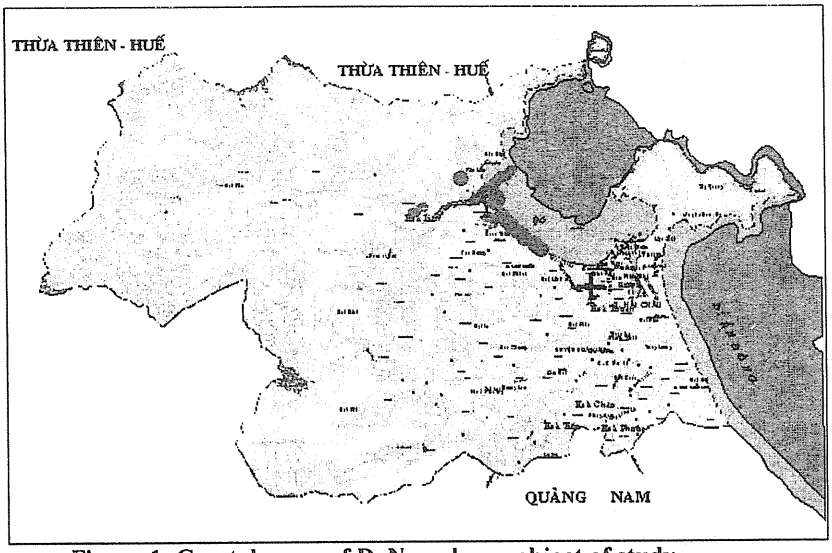

Figure 1. Coastal zones of DaNang bay – object of study

Currently, the water source of Cu De river is seriously contaminated due to the wastes from industrial zones, sand and grit exploitation, deforestation, waste from wards and communes at Danang coastal area that directly affected water source, gulf area ecosystem and health of inhabitants residing in the coastal area. Discharge sources from the shore run into Cu De river including industrial wastes from Hoa Khanh and Lien Chieu; waste water from shrimp farms and agricultural waste water from paddy fields and vegetable fields in the southern bank of Cu De river; rainy water overflows and sweeps away contaminations into Cu De river. Waste water from Hoa Khanh and Lien Chieu industrial zones also converge on this river in the range of 500m far from the estuary. Further to the upper source of the industrial waste water discharge floodgate, there are shrimp farms and sand exploitation places along the riverbank. Furthermore, Cu De river also is the intake door of industrial waste water from paddy fields with area of 25 hectares and waste water from households along the both banks of the river.

The monitoring figures from 3 stations at Cu De river /[4]/ indicate environment is seriously polluted here now. Concentration of parameters in Cu De river increases in comparison with previous years.

Monitoring figures taken from places /figure 2/: station S2 (Cu De 1) 1000m far from Cu De estuary on the upper source (intake waste water from aquatic cultivation), station S3 (Cu De 2): 500m far from Cu De estuary on the upper source (place where intakes industrial waste water). The table below shows the actual status of environment in Cu De estuary area.

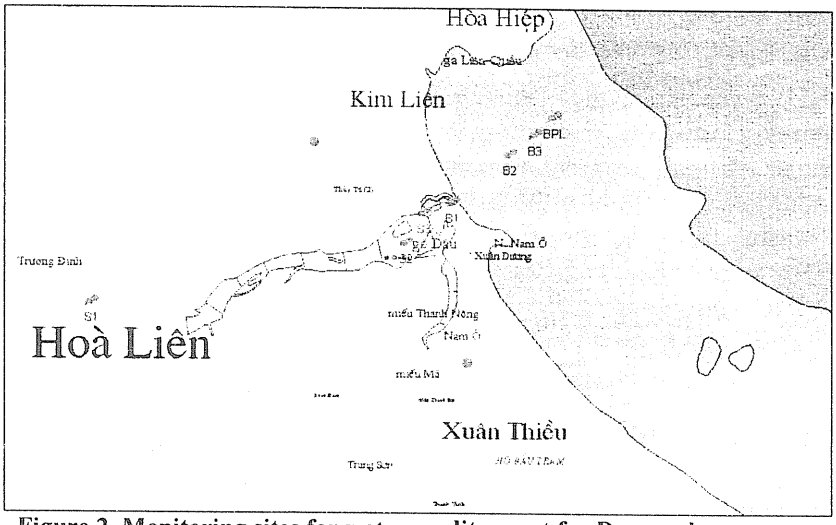

Figure 2. Monitoring sites for water quality coast for Danang bay

It may draw some conclusions as follows:

- COD content (phase 2, 3) is in excessive of standard at 1.48 times. Solid hanging on Cu De river (Nam O bridge) is seriously contaminated, it is place where intakes waste water from Hoa Khanh industrial zone, and thus the SS content is so high and in excessive of regulated standard at 1.9 to 5.4 times. At the lower section of Cu De river is heavily polluted in coliforms, result measured is in exceed of Vietnamese standard 5942-1995 is 24 times, such figure is larger than that of previous years.
- Other parameters are under allowable limit but still higher than that of previous years.

According to assessment of Danang service of resources and environment in 2005, currently, environment at Danang bay area is specialized in issues as follows /[4]/:

- At Cu De river, there are hot spot of 4 norms BOD_5, $N\text{-}NH_4$, Coliforms, As. At Danang bay, there are hot spot in terms of 4 norms of DO, BOD_5, Zn and Phenol.
- In the dry season, lack of freshwater due to the erosion of saltwater deep into the mainland, current from cultivation and irrigation areas, aquatic environment leading to the infection of water source.
- The rapid urbanization, industrialization in line with aquatic cultivation leading to the freshwater shortage and additional increasing of infrastructure to satisfy such demands.
- Unpredictability of natural phenomenon such as quantity and quality of freshwater flow, intensity and length of storms, speed and scope of natural process, for example erosion and extension of coastal line, ecological evolutions and the earth rising.

To solve foregoing issues, it is needed to:

- Building up tool that may evaluate the influence of elements such as: hydrography, tide, loading the pollution over water quality of Cu De river and Danang bay area;
- Promptly discovering the reasons caused pollution to find out violating agent in respect of environment and measures for timely handling.
- Building up management tools to satisfy requirement of the information technology age.

3. BUILDING UP INTEGRATED TOOLS FOR GENERAL COASTAL WATER ENVIRONMENT MANAGEMENT – TAKING DANANG CITY AS A CASE STUDY.

Environmental information system (EIS) is defined as a system based on computer for archiving, management and analyzing environmental information and relevant data [1]- [3]. Based on the practical analysis basis of general coastal management project for Danang, in this article proposes a environmental information system aiding general coastal management mission for Danang. This software is called COAST (Computer prOgrAm for coaStal managemenT for Danang). Structural outline of COAST 1.0 shown on the picture....

Structure of COAST software 1.0 includes main modules as follows:

- GIS
- Environment monitoring data management
- Model
- Relevant environmental information management
- Statistical report module

3.1. Environment monitoring data management module

COAST Software 1.0 proposed here figures out a conjugated solution between GIS and standard data management system MS access.

Following data groups under the management of COAST:

- Monitoring figures of Cu De river water quality;
- Monitoring figures of Nam O estuary water quality;
- Figures on industrial waste water along Danang coastal area.
- Figures related to discharge and elimination from Hoa Khanh and Lien Chieu industrial zones.

COAST provides functions on data exploitation as shown on the figure 3

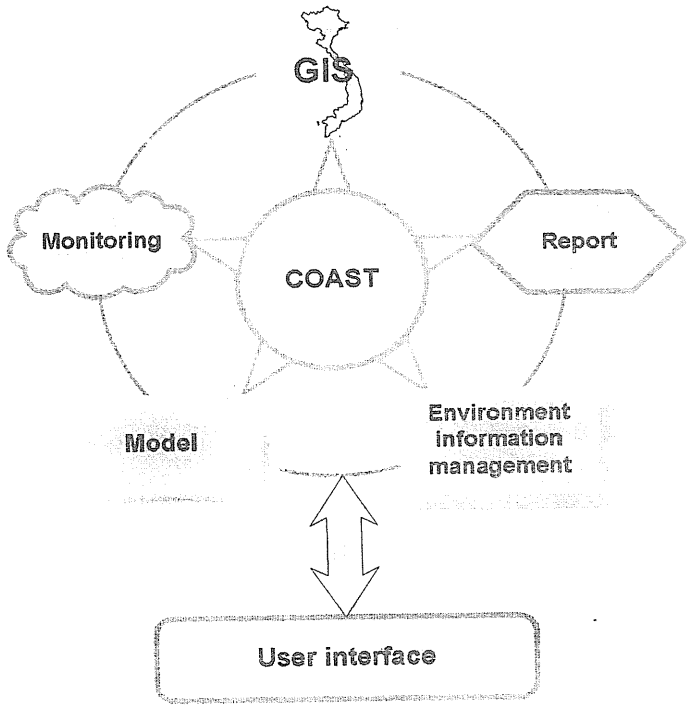

Figure 3. General schematic structure of COAST

3.2. Model module

Environment management on coastal and estuary area in current phase requires a must on evaluating environmental consequences caused by the impact of production over the adjacent area. Hence, the role of model is so important here.

Some authors in previous themes combined mathematic model with GIS and environmental database aiming to help evaluating relationship between economy and environment. In COAST integrated good Segmented Estuary Models (SEMs), Risk Analysis Model (RAM), working outline of this model shown on the picture...these models aid users

on evaluating influences of economic activities over water quality of Cu De estuary area (Danang).

3.3. Relevant environmental information management module

Environmental situation is assessed by several binding parameters and such binding is under the influence of regular changes, thus caused numerous difficulties for the problem of assessing and forecasting adverse impact toward environment. Besides, it is aim to adopt a basic environment decision, managers need a lot of different kinds of information. This enhances the necessity of different information integration in relation to problem to be taken in consideration.

In COAST, following information groups are combined:

- Information about Hoa Khanh and Lien Chieu industrial zones, objects discharge contamination into Cu De river.
- Information pertaining to environment management authorities
- Information about waste water outlet sluices (coming out to the river, sea).
- Information about Vietnamese standard in relation to quality of water environment of river, lake and sea.

3.4. Statistical report module

On environmental management assignment in current stage, environmental report is an integral work. The report is carried out upon the request of managerial authorities aiming to assess environment quality of the object in concern.

As to foregoing practice, in COAST is integrated with tools making automatic report upon request of PEMSEA and environment management agency. COAST enables to conduct report types based on temporal changing figures as follows:

- Water quality at monitoring spots (one or more spots), the content of report is carried out on requirements of managerial assignments.
- Analyzing tide from tide forecast figures provided by Hydrometeorology station located at the middle central part of Vietnam.
- Result of risk analysis model proposed by PEMSEA.
- Computation result from SEM – Evaluating effect of Hoa Khanh and Lien Chieu industrial zones over water quality of estuary area.

3.5. SEM (Segmented – Estuary Model)

In recent years, at Nam O estuary area where Cu De river runs into Danang bay has occurred complicated issues relating to water source infection. In several previous years, this area always supplied various types of aquatic products such as fishes, shrimps, etc. Presently, due to organic pollution occurred fairly serious, so fish and shrimp amount declined distinctly. On the other hand, as for available computation tools still have not any quantitative assessment yet for the pollution picture on surface water of this area. In this work, SEM model was initially applied that presented in [6], [7], [8]. Steps needed to be carried to run this model including:

Step 1: Entering figures of discharge and elimination at Hoa Khanh and Lien Chieu industrial zones. Parameters needed to be entered into this model presented in Error! Reference source not found...

Step 2: Running the model:

Although, computation result is just imitative due to the lack of practical survey figures, certain following conclusions could be drawn out:

- High BOD_5 pollution occurs at the time of ebbing tide and that may be in double.
- Concentration of contamination in waste water gives a big impact to water quality of Nam O estuary area, Cu De river. It is said that some aquatic product processing plants directly discharged into the river. As a result, such induces Nam O estuary area being drastically infected by organic substances.
- At present, Hoa Khanh industrial zone is place where gives more pollution to Nam O estuary area than Lien Chieu.
- If it fails to pay attention to discharge sources being out of control along Cu De river, certainly, BOD_5 infection will reach the level greater than 7-8mg/l at Nam O estuary area.

4. CONCLUSION

In this article proposed a model of conjugated environmental information together with GIS named COAST that aiding the general managerial assignment on quality of coastal water environment in Danang, taking Nam O estuary, Cu De river and Danang bay area as a case study.

COAST includes main functions such as: GIS, environmental monitoring data management, relevant environmental information management and building up statistical reports. In addition, COAST is integrated with Segmented – Estuary Model (SEM) for simulation the spreading of organic infections. This model focuses on the impact of ebbing tide over the spreading. Model enables imitative computation on effect of Hoa Khanh and Lien Chieu industrial zones over the water quality of Nam O estuary area, Cu De river.

Applying Risk Assessment Model (RAM) for Cu De river. This model is taken into COAST aiming to help the automatic computation and making report of risk measurement result for Cu De river.

Some statutory documents were integrated in COAST. These documents help automatic computation and environmental report making as well.

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BUILDING UP AIR POLLUTION PREDICTION MODEL IN HO CHI MINH CITY USING GIS AND NEUTRAL NETWORK TECHNOLOGY

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ABSTRACT

Presently, one of the missions on top priority of authorities at all level in Ho Chi Minh City is the analysis and prediction of air pollution situation in the most populated city of Vietnam to date. To address this problem, it is essential to apply the latest results from variety of technological and scientific investigation works, amongst is information technology, and especially is artificial intelligence approaches in associated with Geographical Information System (GIS). Investigation result originated from the applications of artificial intelligence approaches will enable the circumstance for the appearance of numerous applications on the way toward the use objectives those whom are experts on mission at Resources and Environment Services.

In this work presents the results derived from execution of scientific and technological research project on Ho Chi Minh City level carried out in 2 years 2004 – 2005. The key result of this project is the software product entitled SAGOCAP (Contaminants in the Air Prediction model for SAi GOn) on GIS application and neutral network technique helped to manage monitoring data on air quality at 9 automatic monitoring stations located in Ho Chi Minh City area as well as it is to support air quality prediction at these stations using neural network technique. Through this report, the authors hopes to share the idea and to assert the artificial intelligence integration method with GIS as well and it is particularly effective on the sector of environment decision making.

1. INTRODUCTION

In the context of impact caused by human – being socio-economic activities on ceaselessly increasing that the most important issue is to organize the environmental situation monitoring and continuously monitoring the change of environment and to determine the their tendency of change. In the face of environmental imperativeness in Ho Chi Minh City, since 2000, Ho Chi Minh City Service of Technology and Environment has installed the automatic air pollution monitoring system of which has ever satisfied international standard in Vietnam.

At the time of installing the continuous monitoring system to date, such monitoring data has uninterruptedly been increasing. Though, so many approaches investigated and applied to analyze this information flow, it might assert that there is virtually no any tool used for information analysis on effective (as of temporal parameters), rapid and particularly capable of bring out predictions so far. It is needed to underline that just not in Vietnam where has to confront to such issue. Building up a technology that enables a sole decision making on the basis of huge information flow in a very limited time scale is the great concern of a lot of developing countries worldwide. It was because many countries in the world have taken much time to build up tools on the basis of advanced and powerful technologies such as artificial intelligence. Hence, the necessity on building up such a tool is that:

- To get to know the relationship between various parameters without the expressly interdependence between them is a very difficult work, even in presence of most proficient experts. In addition, it is needed to note that the sometimes, subjective thought of expert leaded to the prejudiced prediction. In the situation of time limited, experts may commit an error.

- The uninterrupted increase of information current and so difficult to expert (even in the assistance of modern database management system as well as other computer methods that help to seek information)

- In the environmental prediction problem, the dependence of pollution with other parameters is obvious but to imitate this dependence could not be achieved by old tools. Another importance is that could be said that this information space is currently too wide and beyond the control, information is so diversified, thus, it is hard to apply conventional information processing methods.

- Neural network was proved fairly strong and effective in reality in prediction problems and data analysis. Neural network applied to prediction pollution is a real demand helping environmental management agencies to figure out appropriate policies and decisions soon.

Thence, the theme entitled "*Research for building up air pollution prediction module in Ho Chi Minh City through neural network approach*" is carried out in line with the goal of forming a closed tool as from information classification, automatic information processing and winding up by information analyzing procedure and pollution prediction. The aim of this theme is the application of neural network technique to predict air pollution at automatic monitoring stations in Ho Chi Minh City based on the temporal monitoring figure range.

2. BUILDING UP NEURAL NETWORK FOR AIR POLLUTION PREDICTION

According to Ho Chi Minh City service of Resources and Environment, currently there are 9 automatic air pollution continuous monitoring stations in Ho Chi Minh City located at: Service of Science and Technology, Hong Bang School, Binh Chanh District Education Bureau, Thong Nhat Hospital, Quang Trung Software Park (District 12), Zoological and Botanic garden (District 1), District 2 People's Committee, Urban administration bureau (Thu Duc District), Tan Son Hoa (Phu Nhuan District). Contaminations are measured at 24/24 including PM_{10}, SO_2, NO_X, CO, O_3. All Survey equipments are modern at high accuracy.

2.1 Designing neural network system used for air pollution prediction.

There are 3 steps on building up neural network model: data pre-processing, network training and prediction (result output) and respectively to foregoing 3 steps, neural network model for air pollution includes 3 main modules as follows:

Data preprocessing module

- Data of our survey from monitoring stations are recorded in the form of Excel file then data preprocessing module will convert such data into database SQL Server 2000.

- Apart from data we got from monitoring stations, usually there are a lót of errors that such errors caused by the incapability of survey equipment. Such values therefore are eliminated. This is the step of interference elimination.

- After completing interference elimination, we move to data highlight stage. Data highlight means that we have to highlight the property of pollution data prior to entering them into neural network, namely in air pollution prediction problems at automatic stations, we may realize that this data is cycle nature as of hour of day, day of year and month of year. So, hour, day, month values are selected here as the role of 3 signals to enter into neural network.

Network training module

This module enables user building up network architecture and configuration of parameters. Then, such module employs processed data file to train network. This step is

divided into 2 smaller ones are training and verification. The network training step employs 90% of available data. Verification step employs approx 10% of the rest to verify the quality of the network to get to know if the network is on good running. After that, we evaluate error of neural network that we have completely trained.

Prediction module

This module enables user predict needed results.

2.2 Applying backpropagation technique into air pollution prediction problem

In order to build up air pollution prediction model as of continuous monitoring data range under neural network technique, in backpropagation algorithm application theme.

The steps of construction include structure determination as well as the selection of binding important number training algorithm. After training, we take the role model of prediction function. Based on this prediction function, we may determine value of contaminations.

Structure

Today, multilayer feedforward network architecture is mainly used on prediction application.

- Input layer: number of neuron of input layer is equal to direction of vector **X**. It is the meteorological condition number + outstanding data number + temporal factor.

- Hidden layer: number of neuron may change at own discretion

- Output layer: Number of neuron is the value of contamination concentration that we need to prediction.

Sample data selected in the theme

Sample data set of training process in this theme is set $X = \{(x_i, d_j(x_i))\}^N_{i=1}$

Where:

- x_i – is the vector of meteorological condition values (Such as Max Temperature, Min Temperature, wind velocity, wind direction, head, radiation intensity), time, value of contamination concentration after being highlighted.

- y_j (j =1, 2,...J), value of contamination concentration needed to be predictioned.

- $d_j(x_i)$ – is the prediction value

There are a lot of approaches to highlight data, in this theme used n past data approach to prediction data n + 1. Table 1 shows rules for highlighting in this theme (n=3).

Table 1.Way of selecting value highlighted for predictioning.

Day	Hour	Concentration value of contamination selected	
1/1/2003	1	12.4	Input
1/2/2003	1	11.5	
1/3/2003	1	4.6	
1/4/2003	1	6.5	Output

Carrying out back-propagation algorithm in the theme

As presented in previous chapter, training process on neural network using back-propagation algorithm includes 3 stages: feed-forward stage of input signal, in this stage, forward procedure is called out to execute forward-propagation stage – constitutes the value

determining of the mapping on the basis of existing coefficient), different error computation stage between desired value and value really gained from neural network and the ultimate stage is the adjustment of connection weights

- Feedforward stage: Each neuron in input layer gets the input signal and sends this signal to all neuron in the hidden layer. Each neuron in the hidden layer gets signal from the input layer will calculate the output via activation function and sends the calculation result to all neuron in output layer. Neurons in the output layer will carry out the same calculation with neurons in the hidden layer.

- Backpropagation stage: During the training process, after completing the calculation of value at the output, each neuron in output layer will compare the gained result to desired value to determine the different error between them called error signal. Information about error signal will be used to adjust connection weights on the direction as from the output layer to the hidden layer and continue doing so until the last one in input layer.

- Adjustment stage: It is the final step of training process. There are two ways for adjusting connection weights: Batch form way refers to the update process of connection weights occurred as all training samples processed. Incremental way refers to the update of weight occurred soon after a sample was completely processed. However, incremental way is used much more in prediction problem.

2.3 SAGOCAP tool – automatically computing air pollution prediction under neural network technique model

Within the scope of this theme, the authors built up SAGOCAP (Contaminants in the Air Prediction model for SAi GOn) software applying of GIS and neural network technique to carry out air pollution prediction function.

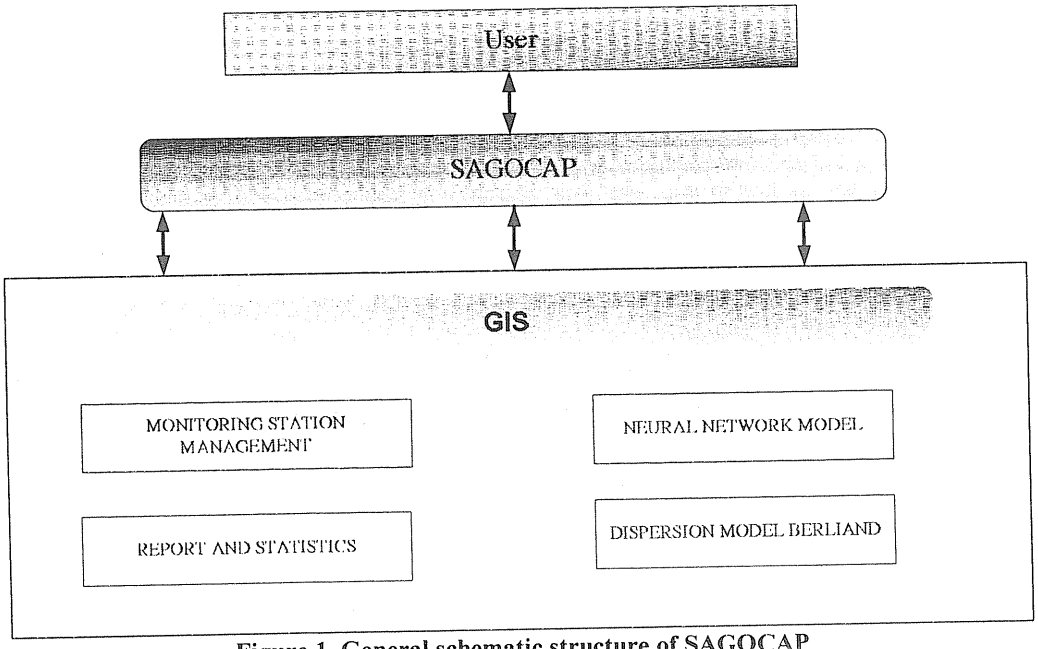

Figure 1. General schematic structure of SAGOCAP

SAGOCAP version 1.0 enables managing subjects related to quality of air environment: monitoring figures on air environment pollution from 9 automatic gauging stations, surveyed meteorology figures and enables predictioning air pollution. These subjects are fixed to numerical map on the Hochiminh city ground. The overall sketch of SAGOCAP shown in Figure 1, SAGOCAP has following key functions:

- Central administration and unifying the monitoring data from 9 automatic monitoring stations, the quantity of such stations may increase, thus SAGOCAP enables users opening new station as in the need;

- Conducting statistical functions, report on the basis of figures entered into database. The batch sketch of this function is shown above

- Conducting prediction functions as per neural network method. The working outline of this module is shown on fig. 2.

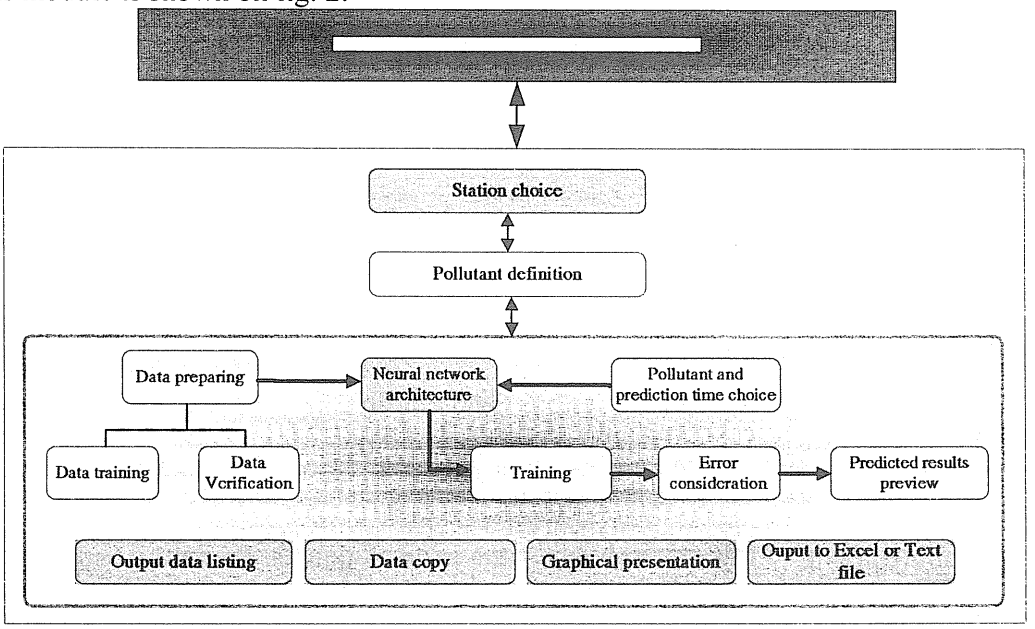

Figure 2. Working schedule of prediction model in SAGOCAP

Figures used in this theme provided by environment protection branch of Ho Chi Minh City as per contract. From Excel format file is converted into format SQL. then, the user needs to select the date needed to be predictioned as well as station and substance needed to be predictioned (there are 9 automatic monitoring stations in Ho Chi Minh City).

The next will be the self training process over available figures. This study process is kept continuing until an acceptable error attained and then stop. It is aim to test capability of SAGOCAP1 version 1.0, authors employed the dataset of 2003 for self training process of SAGOCAP1 and then outputting prediction results of 4 days in early 2004.

2.4 Result of air pollution prediction using neural network model

Within the performance framework of this theme, from June, 2005 to December, 2005, SAGOCAP product was installed at the bureau of monitoring and evaluating environment pollution subordinated to Ho Chi Minh City environment protection branch. The neural network model testing was just conducted by staff of environment pollution monitoring and evaluation bureau upon the contract on fixed rate professional hiring between the theme head and Ho Chi Minh City environment protection branch (certified by Institute of application mechanics, the governing body of the theme), below presenting certain results were initially received.

SAGOCAP is used for prediction goal at monitoring locations: Thong Nhat Hospital (PM_{10}, CO), HCMC Service of Science and Technology (O_3), Binh Chanh district education department (presently belonging to Binh Tan District) (NO_x), HCMC Zoo (NO_x), District 2 People's committee (NO_x, PM_{10}). Comparison result between value predictioned by SAGOCAP and real gauged value presented in form of chart below at some stations /fig. 3/.

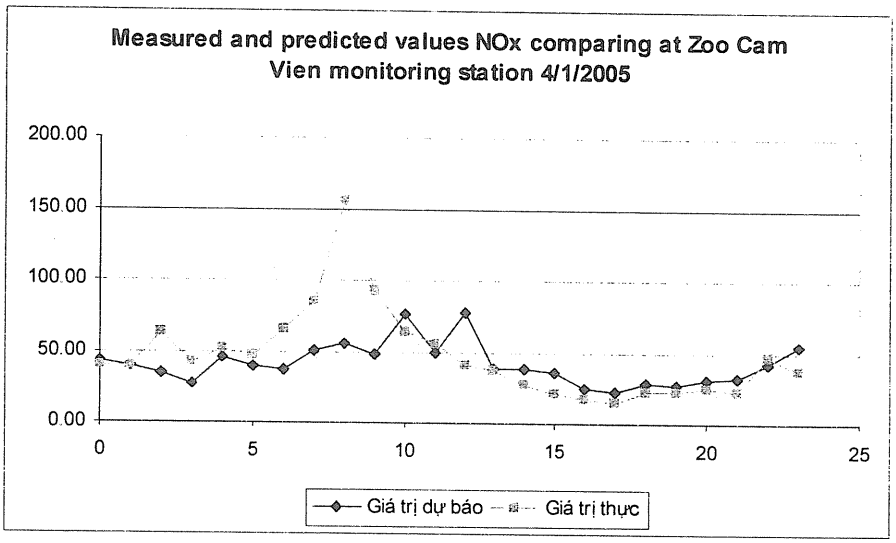

Figure 3. Measured and predicted values NOx at Cam Vien zoo monitoring station at 4/1/2005

4. CONCLUSION AND PROPOSAL

The main result of this article is a tool for promptly and analyzing temporal changing monitoring data and particularly it may expose air pollution prediction. The result of this research was applied to prediction air pollution in Ho Chi Minh City. Informatics tools built in this work enables resolving tasks of environmental figure administration in current stage.

The shortcoming of this research is just the issue of figures. Presently, temporal figure range provided by automatic monitoring gauge being in serious error that interrupted such figure range. Through analysis, the author found out that most of data were interrupted and yet the degree may vary on the basis of every station or every substance. It is difficult to improve the accuracy of the prediction.

Artificial intelligence technique in general and neural network technique in particular plays a great role on handling socio-economic issues and environment as well. The result of this theme enables affirming a possible prospective of on solving abovementioned problem through advanced technology.

5. ACKNOWLEDGEMENTS

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A GIS – BASED APPROACH TO ENVIRONMENTAL SOFTWARE APPLICATION: RESEARCH AND DEVELOPMENT

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ABSTRACT

This report presents some results in terms of software on research and development to serve assignments of research, training and technology transmit carried out for the past time at Geoinformatics department

1. GENERAL OUTLINE

- Currently, research work on information technology application, environmental databases establishment become urgent.
- Information technology application research in general and Geographic Information system – GIS in particular into environmental management assignment have been strongly developing in many places.
- Achieved results enable the construction of informatics tools on figure management, and enable managers on decision adoption.

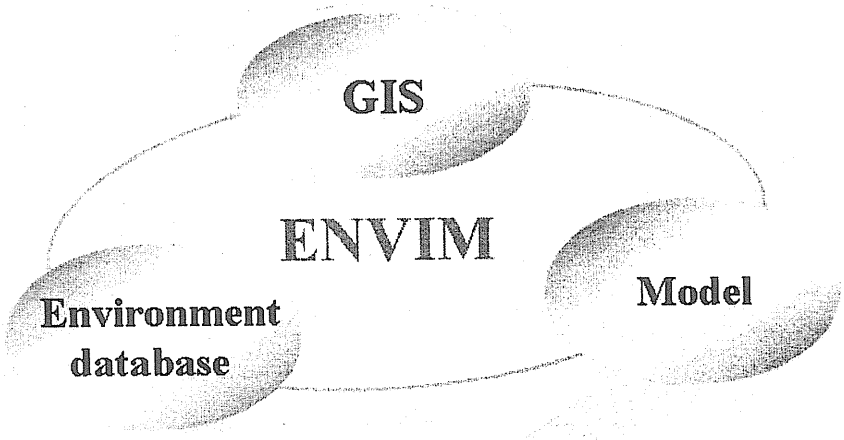
2 PRODUCTS OF RESEARCH

ENVIM is the software aiding environment management and pollution monitoring at provincial level with key functions as follows:

- Managing environmental quality monitoring data
- Model dispersion pollution computation
- Providing environmental information to objectives of which are interested in environment quality.

ENVIM applies GIS, Database and Web technology with several utilities that help user on reference as well as computation in various scenarios.

3 INTEGRATION GIS TECHNOLOGY, DATABASE AND MATHEMATICAL MODELS



4 SOME RECENT RESULTS

1. Building up informatics tool for supporting on monitoring and managing environmental resources in Ninh Thuan province. Ninh Thuan provincial level project.

2. Building up integrated GIS tool with epidemic diseases distribution data and epidemic prediction epidemic model (under directly the theme at ministerial level of Public Health "Building up top dangerous prediction index A00 (cholera)" on the basis of supervision in terms of epidemiology, microorganism and geography – climate factor in Mekong delta provinces". Ministerial level project of Ministry of public health

3. Research and building up air pollution prediction model in HCM city using Neuron network approach. Municipal level scientific and technological project of Ho Chi Minh City

4. Research and building up CHARM model application for environmental risk assessment when using chemical on exploring and exploiting petroleum in the Vietnam Sea.

5. Building up database on environment monitoring and environment inspection at Ba Ria – Vung Tau department of Environment & Resources province. International project SEMLA

6. Fundamental investigation, assessing current status on exploiting and building up database from specialized software to serve management, exploitation assignments and reasonably using water resources in Da Nang City, Danang city level project 2006

7. Building up informatics tool on supporting environment monitoring and assignment in Tra Vinh. Provincial level scientific and technology project of Tra Vinh province.

8. Building up GIS application software on general management in terms of submerged spots, water drainage and mud water quality in Ho Chi Minh City area (below section is abbreviated to TOWN). Hochiminh city level project, Department of Public transportation