Webgis Platform for the detection and the early alert of forest fires

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ABSTRACT

The project tries on the study, design and development of a Webgis Platform, for the protection of forests, fragile ecosystems and protected areas, by means of techniques of satellite remote Sensing, neuronal networks and the digital treatment of signals (DSP). The governments of the Republics of Cuba, Haiti and Dominican Republic have been suitable the establishment of a Biological Runner of the Caribbean, like strategy of conservation of the biodiversity and the integration of the communities, within the framework of a type of harmonious development with the nature. The Formulation and beginning of strategic operations for the development of the potentialities of the protected areas, especially tie to the sustainable tourism. The conservation of the Biological Diversity has reached global importance, no longer is only the aspiration of a group of scientists or environmental activists. At the moment more and more people, understand that the perdurability of the human species is closely ligature to the Earth life and all their complexity of forms, species and ecosystems.

Keywords: Webgis platform, fire detection, early alert, fragile ecosystem, biological runner**.**

1.0 INTRODUCTION

The initiatives and agreements that the governments develop to stop the loss of the Biological diversity are multiple, but there results still are insufficient and they do not indicate a reduction of the rate of extinction of species. Some regions of the world constitute true sanctuaries of the life and all is almost put under intense pressures of or urban industrial, agricultural the development. He is indispensable to fight the poverty that affects to many of the zones with high values of biodiversity. The creation of new productive options based on a coherent relation with the Nature is urgent that impel of harmonic form the increase of the quality of life of the communities and in parallel the maintenance and the conservation of the Biodiversity. (In the last years the global changes are gotten up like a new element that impels the disappearance of species and ecosystems, groups as the amphibians face the risk of extinction in mass.) Place (it is) of Execution Area pilots "Running Biological of the Caribbean".

Our actions tries on the implementation about the nucleus or motor here about the system WebGis Geographic Information, for the design of a Gis Platform through the Web.
The project is oriented to the design of a platform Web for the service to the clients or users that will connect to the platform, so everyone can unfold the options of a local GIS in our case for "study and analysis of the forests, afforest and it" from a computer science Platform in the WebGIS.

We are interesting in develop a system of satellite monitoring, that generally allows the access of the authorities and interested persons to a information in real time on the variabilities of our protected natural surroundings: vegetables and animal, through a platform Web. This Platform would contribute to the indicators with details on the possible forest fire CONATE and on the diminution or damage to the vegetal layer that take place in our Country, with special attention to the biological runner of the Caribbean, among others. These actions would be realised by means of remote sensing, using the information of free payment collected of the satellites with sensors like the Modis of the University of Maryland, collected and distributed every 24 hours, and that alert to us through detectors of hot spots and variation of the expectral characteristics of the vegetal mass.

This Platform proposed Web of geographic information, would allow the pursuit to the environmental indicators that describe of the change of the hot spots in the surfaces under study and its possible characterization by means of comparison with the values of previous days, standardized like normal. The information collected by this means would be available in a Web server for environmental use online and/or its storage and possible after treatment by the personnel of the Secretariat of Environment and Natural Resources ¨ **Semarena**¨. It is thus tried to be able to give to pursuit to the fulfillment of the norms and environmental laws that try on the subject in the Dominican Republic, and to contribute to assure the care our forests, parks, like of the beings who we depend on its interaction with the nature to assure one better quality of air, water and life.

1.1 METHODOLOGY AND WORK PLAN

The way has to follow for the development of the GIS through a Platform Web, to give pursuit and alerts early of the fire CONATE and of the possible degradation of the quality of the vegetal layer it is of the exploratory and scientific type; denoting the phases of the scientific research from the determination of: 1.) the relevance of the project; that it must observe: a) the social necessity on the problem to be solved, b) the newness or innovation in the solution to the problem, c) the identification of the human and economic resources to be able to approach and to solve the problem of the lack of a GIS through a vestibule Web, to give pursuit and alerts early of the fire CONATE and the possible degradation of the quality of the vegetal layer that requires the Country. 2.) The determination of the actors and primary beneficiaries of the resources that are soon used in the development of the project and their projection and factor of multiplication in the Dominican society, the one that would be indicated like final beneficiary. 3.) The phase of instrumentation or physical concretion of the model; through design, development, manufacture and operation of the model a GIS through a vestibule Web, to give pursuit and alerts early of the fire CONATE and the possible degradation of the quality of the vegetal layer; these activities would be realised in the facilities of the campus

of the Unapec, under a budget and a cronogram that would be making ahead but. 4.) The people involved in the development of the project are going to be the investigating professors and students of term of the races of engineering of the Apec University. 5.) The investigation techniques that are going away to use are: The bibliographical search and the interview in order to successfully obtain the opinion of experts, the exploration by the students to the solution of the problems that consider during the development of the project (heuristic search, cognitive imbalance, instructive strategies, strategies of learning and strategies of socialization among others). 6. - Unapec this open (o) to receive scholarship holders of other places so that they enter from beginning to participate in the project. 7.) Finally the reach of the project, also includes the curricular area pertaining to the development of abilities and professional competitions of our students.

1.2 DEVELOPMENT OF THE ELEMENTS OF THE PLATFORM

A GIS : is an organized integration of hardware, geographic software, data and personnel,
designed to capture, to store, to manipulate, to analyze and to unfold in all forms the geographically referenced information with the purpose of to solve complex problems of planning and management.
The SIG works as a data base with geographic information (alphanumeric data) that is associate by a common identifier to the graphical objects of a digital map. This form, indicating an object their attributes are known and, inversely, asking for a registry of the data base its location in the cartography can be known.
The GIS separates the information in different thematic layers it stores and them independently, allowing to work with them of fast and simple way, and facilitating to the professional the possibility of relating the existing information through the topology of the objects, with the purpose of to generate another new one that we could not obtain from another form. Our Platform settles down through the secured space geodesic elements online of gratuitous way in the sites dedicated to the world-wide pursuit of the climatic variations in the continents. We set out to integrate a semiautomatic platform through a menu of hyperbonds with one
¨**Screen of the geoclimatic Platform** ¨ as element of local or remote access to the services of pursuit georeferentiated to the possible points of the CONATE of fire and reduction of the vegetal layer among others.In the process we are working abities and developing competenties for our studends.
The interface webgis can be acceded by common users (with authentication keys) by means of the connections remote facilitated by servants of global connectivity like team Viewer, Logme in, PC anywhere, etc.
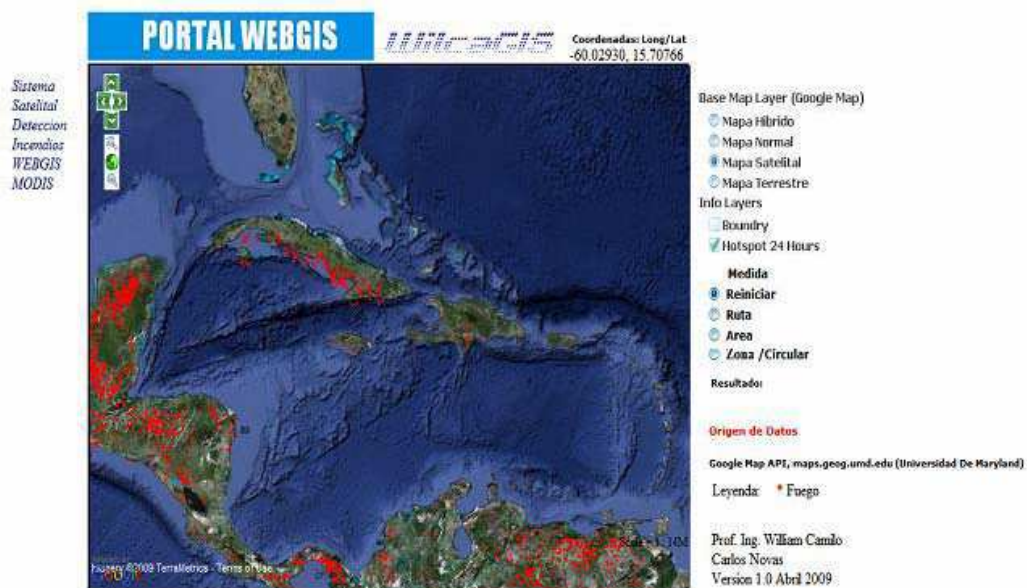
Figure 1: Screen of the geoclimatic platform

1.2 CAPACITY OF THE SYSTEM

Now we are trying to coment, all the process of recovery the satellital data, and develop a virtual web chart, that allow us with a html arrange menu, display our maps, fires points, etc. and be able to implement a Proportional, Integrated, Derivated Control System (P.I.D.) with the neuronal data information, then calculating each day, looking for variations in the hots spots presented for the virtual web chart feeded by Modis Satellite data. So if we have differents numbers of points, we have the possibility of a new forest fire, and its possible place in our platform chart.

So the system is able of: 1) Continuous and interactive exploration without needing recharging the page. 2) Options of navigation by keyboard (Approach and exploration) 3) predetermined scale Approaches 4) Samples of geographic information. 5) Measurement of distances and Area. For the implementation of these systems, we used API (APLICATION PROGRAMING INTERFACES) written in language Javascript of open code available in Internet for the development of dynamic Webgis systems. We will be using these bookstores of development under the scheme of licenses BSD of open code for the development of applications. We will be developing a geographic application based on Web, similar that the Virtual Google Maps and MSN Earth, with the difference which we will be basing us on free code. In this project, we will exactly be using the data base of maps of the Google Maps, that is the strongpoint of google earth, using the APIS that they provide free in Internet. This can be found in http://code.google.com/apis/maps.(1)

Figure 2: Google Maps 1 Basics

After we have our platform of maps, the following step is to have the capacity to represent the information of hotspots in the map. This is obtained using APIS of OPENLAYERS, which give the support us to be able to handle to markers and information in our maps.
Http://www.openlayers.com. (2)

Figure 3: Google Maps Basics 2

The data of the hot spots, we are obtaining them from the information system of fires for the system of handling of resources (Fire for Information resource management system FIRMS) developed by the University of Maryland, that Integra technical of remote sensing and GIS to give global information of location of Points I warm up. http://maps.geog.umd.edu/firms/. From this site we obtain the archives of text that is put available in the site in periods of 24 hours, 48 hours and of 7 days of the week. The archives are updated hourly beginning the 00:50 time of the east of The United States.

Figure 4: System of Web FIRE to mapper of satellite Modis.

2.0 The fundamental element in any application of the API of Google Maps is the own map.

Figure 5: Basic Cartography of the system

There are five aspects that are due to consider in the development of Webgis systems being used api of google: We include the code Javascript of the API of Google Maps by means of the label script. We create an element div denominated " map_canvas" that it lodges the map. We write a function Javascript to create a map object. We center the map in a concrete geographic point. We initialize the map object from the event onLoad of the label body. These steps are explained next.

2.1 LOAD OF THE API OF GOOGLE MAPS

Load of the API of Google Maps The direction URL http://maps.google.es/maps?file=api&v=2&key=abcdefg directs to the location of the file Javascript that includes all the symbols and definitions that is needed to use the API of Google Maps. In order to accede to the API, the page must contain a label script with the key received during the inscription directed to this direction URL. In this example, the key is indicated like " abcdefg."

2.2 MAP ELEMENTS

```
<div id="map_canvas" style="width: 500px; height: 300px"></div>
```
So that the map is in a page Web, we must reserve a place for him. Normally we obtained, it creating an element div with name and obtaining one reference to this element in the model of document objects (Dom) of the navigator. In the previous example, we defined an object div denominated " map_canvas" and we defined its size by means of style attributes. Unless a size for the map by means of GMapOptions in the constructor is specified of explicit form, the map will use size of the container to define its own size.

2.3 GMAP2: THE ELEMENTARY OBJECT

```
var map = new GMap2(document.getElementById("map_canvas"));
```
The class of Javascript that represents the maps is GMap2. Each object of this class defines a unique map in a page. (You can create more than an instance of this class, each object will define a different map in the page). We create a new instance of this class by means of the operator new of Javascript. When creating a new instance of map, specific a node SUNDAY in the page (normally an element div) like container for the map. Nodes HTML are secondary from the object document of Javascript and we obtain a reference to this element by means of the method document.getElementById ( ). This code defines a variable (denominated map) and assigns the variable to a new GMap2 object. The GMap2 function ( ) is a constructor and its definition is next:

2.4 CONSTRUCTOR DESCRIPTION

```
GMap2(container, opts?)
```
It creates a new map within determined container HTML, that normally it is an element DIV. Also you can pass optional parameters of GMap2Options type in the parameter opts.
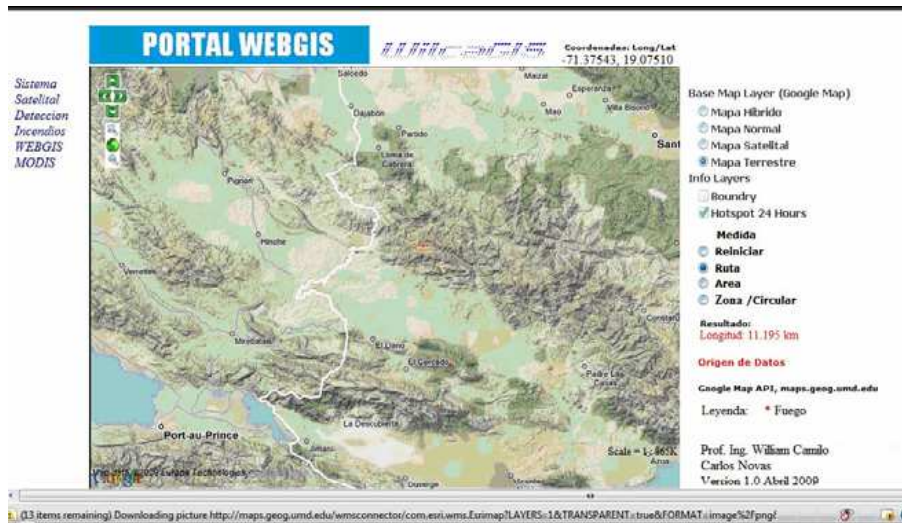
Figure 6: Creating new map 1

We must consider that, since the types in Javascript are dynamic, is not necessary to pass any optional parameter in the constructor.

2.5 BOOT OF THE MAP

Map.setCenter (new GLatLng(37.4419, -122.1419), 13);
Once created the map by means of GMap2 constructor, we must order to us of another task: to initialize it. The boot is carried out by means of the method to setCenter ( ) of the map. The method Seth Center ( ) requires a GLatLng coordinate and a level of approach. It is obligatory to send this method before carrying out any other operation in the map

2.6 LOAD OF THE MAP

<body onload="initialize( )" onunload="GUnload( )">
While a page HTML is processed, externaliza the model of objects of documents (DOM) and the images and external sequences of commandos are received e they incorporate to the object document. In order to only guarantee that our map year to the page when loading completely, we only executed the function that creates the GMap2 object when the element of page HTML has received an event onload. In this way, we avoided an unpredictable behavior and we obtain more control about the way and the moment at which the map is drawn. The attribute onload is an example of manager of events. The API of Google Maps also provides several events that can " detectar" in order to determine the changes of state.

2.7 PICK UP AND STORAGE OF IMAGES TO DISCRIMINATE FIRES
a) the pick up and storage of the images of every day for its interpretation and characterization in a digital data base.
b) Discrimination Infrared Bands of the images
c) Digital processing of images

3.0 A NEURONAL NETWORK

A Neuronal Network is basically model structure and an algorithm so that the model fits to provided data. The approach in networks for the modeled one of a plant uses a generic non-linearity and allows that the parameters are fit. This way they are possible to be handled a high rank of non-linearities. Learning is the process of training of a neuronal network to represent the dynamic ones of a plant.
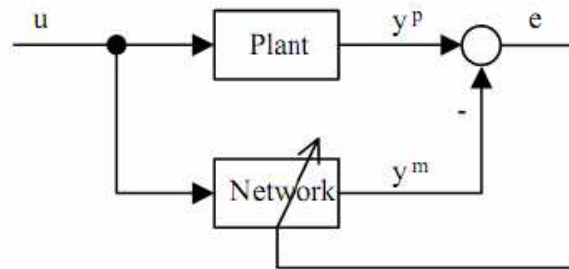

Figure 7: Control system fed back of the neuronal network

A neuronal network is placed in parallel of the plant and the error and between the logout and the network of exits, the prediction error is used like a training signal. The neuronal networks have a potential for intelligent control systems so that these can learn and to adapt, they can come near to functions nonlinear, are apt for the parallel processing and distributed and model systems naturally multi-variate. If a physical Model this available one or is not very expensive to be developed, a model of a neuronal network can be the alternative.

3.1 THE PERCEPTRON

Perceptron is the simplest form of a neuronal network, is able to classify data in two classes. Basically this it consists of a Simple neuron with a number adjustable of weights. The neuron is fundamental processor of a neuronal network, and has three basic elements: 1. A set of connections; Each takes a weight (or gain) 2. A sumador that adds the entrance signals after they are multiplied by his respective weights. 3. An activation function that limits the exit of a neuron. Typically the exit is limited the interval [0.1] or of alternative way [-1.1]. The sum in a neuron also includes a OFFSET to fall or to increase the net value of the entrance. Mathematically the entrance of a neuron this represented by a vector and exit by scaling the weights of the connections they are represented by a vector where it is the OFFSET. The Exit calculates like: The following figure is perceptron with two entrances and offset. With it limits forced like activation function, the neuron respectively produces an exit equivalent to +1 or -1 that we can associate with C1 and C2,
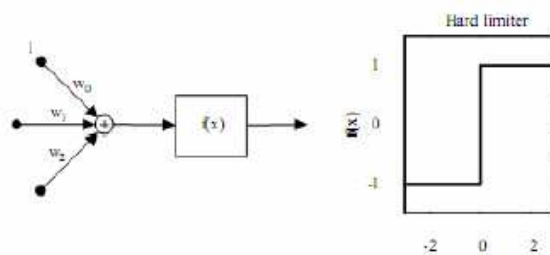

Figure 8: Training perceptron

3.2 MANUFACTURE, CONFIGURATION AND TRAINING OF THE NEURONAL NETWORK IN MATLAB APPLIED TO THE MODIS

Training of the neuronal network I concern each one of the images to the MATLAB. By means of visual analysis and using known the statistical information of Hotspots, the known pixels of hotspots were

identified in the satellite image and that presented/displayed high temperature in channel 3 of the satellite. For the recognition of the fire landlords in matlab we only must take the thermal image, to only discriminate leaving the points of greater value (this way we will only have in the image possible fires) and later we will be using capacities of recognition of landlords of perceptron. In order to realise this, we took the image and to we turned into a matrix, in which the rows and columns are the values of horizontal resolution and vertical of the acquired image. We come to do to which we would call Scanner in the image pixel by pixel until arriving at I complete, We would make a programming sequential. Each pixel that is white (value 1) it is catalogued like fire. Each pixel in the figure is compared with its immediate neighbor and in the case that a pixel is black (Value 0) his immediate neighbor is white (Value 1), this classifies itself like part of a fire edge. It is assumed that to be processed image projects in a matrix in which each pixel this connected to perceptron, that also it receives entrances of his neighbor immediate. The following figure shows the form of a receptive field, (called neighboring Moore) and the weights of the connections to perceptron.
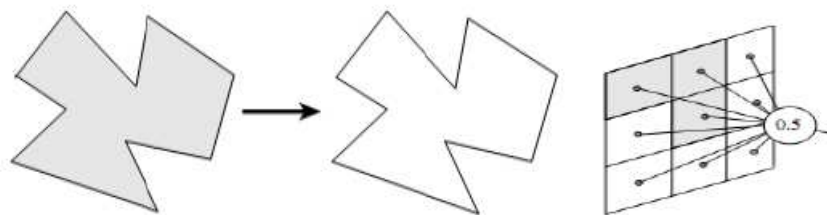

Figure 9: Receptive Field of perceptron

By each pixel projected in the matrix, the weight of entrance is compared with the value of comparison 0.5. When some point is major that the value of comparison, it means that we have hotspot. To these we will store them results in a resulting matrix, which treated as a layer (Layer) and after finished all this analysis, will be superposed in the original image, showing the HOTSPOTS.
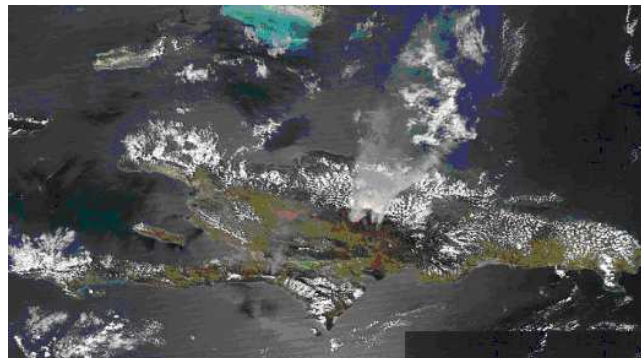

Figure10: Fire image in the Dominican Rep. of the 21 of September of 1997, satellite DMSP

4.0 CONCLUSIONS

Our investigation presents what is the GIS and how they applied by means of the use of the Matlab and the LabView, among others, for ecological service. These programs of manipulation and analysis of signals allow the simulation us of the different behaviors from the computerized systems. The monitoring and control via Web through Internet use the facilities of the remote writing-desks of free payment.

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http://code.google.com/apis/maps.(1)
Http://www.openlayers.com. (2)

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