Webgis Innovation for Forest fire, Gas and Dust Particle Early Alert

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ABSTRACT: This project is about the study, design and development of a Webgis Innovation for forest fire, gas and dust particle early alert 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, gas and dust early alert, fragile ecosystem, biological runner.

1 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.

Our Motivation is also as an answerto the following aspects are of interest for the SEMARENA, SESPAS and the City councils:

- Measurement of noises in residential, industrial and commercial zone
- Measurement of concentration in air of: CO, CO2, NOx, SOx, O3, Particulado Material (PM10 and PM2.5), Solar radiation and others.

(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 deal with on the implementation about the nucleus or motor here about the system webgis Geographic Information, for the design of a Gis vestibule through the Web. The project is oriented to the design of a platform Web for the servant to who the clients or users will connect themselves; so that this one 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.

To develop a system of satellite monitoring, that generally allows the access of the authorities and interested to a information in real time on the variabilities of our protected natural surroundings: vegetables and animal, through a vestibule 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 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. With this it is taken care of the following high-priority points for the environmental management in the Dominican Republic: Air contamination by movable and fixed sources and environmental Health.

2. General Objective

To develop a system of monitoring of forest fires conates and polluting agents (auditory and atmospherics) by means of remote sensing, using the communications nets of electrical energy and telecommunications and/or the Internet. This System would allow the pursuit to the indicators of sonorous quality and the air, through the communication in real time with measurers of polluting agents and transmitters of data strategically located, to be used for the georeferenciada location of the sources of sonorous environmental contamination and gas, besides the contamination by particles, in critical areas of the national territory. 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 thus to contribute to assure one better integral health its citizens and other alive beings.

3 Specific Objectives:
1. To install the multiple detector with sonorous monitoring and of quality of air, once contacted its funcionabilidad by means of the modelling through software in computers and laboratory tests.
2. To promote the development of abilities and competitions in students and professors, thus as the creation of an investigation culture and develops by means of days of qualification on the use and importance of the systems of geographic information with space components of detection of sonorous polluting agents, of gas and particles of dust in our citadina atmófera.
3. To present the results the process of investigation supported by our environmental authorities the scientific society. Also to socialize our works to the people interested in the use and handling of the equipment and facilities of high tech developed under agreements between the Semarena and the institutions of investigation of education superior after the securing of the quality of the environment.

4 Component (Results): Installed R.1 a system multiple detector with sonorous monitoring and of quality of constructed and equipped air. R.2 Enabled professors and students in the new system multiple detector with sonorous monitoring and of quality of air. R.3 Results of the project spread to the Dominican society.

5 Activities by Products: Installed R.1 a system of multiple detector with sonorous monitoring and of quality of constructed and equipped air. • Hiring of personnel of administration of the project • Hiring of the mechanical personnel for the construction and installation of the system. • Acquisition of equipment for the construction of the system • Acquisition of software for the modelling of the design • Acquisition of material costable • To construct physical facilities to lodge the system • Interviews to expert on the designed system. • To take steps to acquire permissions and the insurance for the construction of the system R.2 Enabled professors and students in the new system of detector manifold with sonorous monitoring and of quality of air. To realise 4 factories of 4 hours each on importance, construction of systems multiple detector with sonorous monitoring and of quality of air. Visits from observation to the facilities where the system settles and works R.3 Results of the project
spread to the Dominican society. An encounter of socialization of results in the facilities of the University Participation in radial, televising programs and publication in press written of the results.

6 Strategy:

Related sets of tasks to each other that the project must realise to obtain its awaited results. 1. Development of the general Hypothesis of the investigation of the project that establishes the one that if we constructed a system multiple detector with sonorous monitoring and of quality of air, characterized by the detection of the sonorous quality and pollution levels of the air, with the consequent transmission of the data in real time to the organizations of pursuit of the Semarena; we solve the problem of the uncontrolled contamination in the centers urban, and national population in generally equipping the authorities ordered of the ordering and fulfillment of the environmental regulations of instruments and effective tools for the pursuit and control to the polluting sources.

7. METHODOLOGY AND WORK PLAN

The way has to follow for the development of the GIS through a vestibule 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 our University, 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 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. – Our University is open 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.

8. Possible model of station of monitoring in a small container for our project.

The suspended particles smaller of 2.5 micrometers or PM2.5 are polluting of the air that come from the diesel combustion of vehicles or gasoline and other human activities like industrials, the wild fires or the metal melting.
Fig. 1  Possible distribution of the stations in container and in the form of towers.

Fig. 2  Diagram of soundmeter

Fig. 3  Market devices

Analyzer of size of dust particles km 3887 analyzer of size of dust particles for the measurement of particle content in the atmosphere it counts particles with a thickness of 0.3, 0.5 and 5 232
µm/RS and software The analyzer of size of dust particles km 3887 measures particle concentration like dust, soot, pollen and other aerosols that are in the air. The analyzer of size of dust particles has been developed to detect of exact form the degree of contamination of the air. The contamination is generated mainly by means of combustion, processes of material, manufacture, production of energy, emissions of vehicles and in the industry of the construction. With the aid of this analyzer of size of dust particles it can measure the precise amount of particles polluting agents in the air. It will find stops degrees of contamination of the atmosphere mainly in cities and the sector of the industry and will be able to measure it with the particle analyzer. Every time the degree of contamination of the air with pernicious particles for the health acquires more importance, for example, the soot, that the industry and the vehicles with diesel engines without a special filter emit mainly. These particles of dispersion are responsible among others things for a reduced visibility, the aspiration of poisonous substances and therefore of an effectiveness of the reduced work and can be measured and be controlled with the particle analyzer. For a long time also one knows that the particles can be one of the agents causes of diseases like asthma, bronchitis, respiratory diseases of skin and (Explanation of some definitions in the particle measurement). analyzer of size of dust particles has been developed for a simple and fast use. He advises himself to become familiar with the analyzer of size of particles and the different atmospheric conditions. It is normal that counts show to fluctuations majors. That depends, for example, of daily changes in the atmospheric conditions. Here it will be able to find another dust particle analyzer that measures 5 particle thicknesses simultaneously, speed of the air, memory and RS-232. It will find more information and a general vision of another type of dust particle analyzer if it follows the following connection (analyzing of particles).Dust particles considers the tendencies in concen- during prolonged periods of time, and not as much the differences of measurements followed. The analyzer of size of dust particles works in different ways.

Engineering specifications of the particle analyzer Thickness of µm and 5 0.5 0.3 particles µm/µm . Software of analyzer Software particle.
Fig. 5 Dust particle detector

The analyzer of size of particles and the contamination the contamination is the appearance of a substance that can bring about some damage or imbalance in the alive beings or to the environment. But, to be able to speak of contamination, the polluting substance will have to be in sufficient amount like bringing about those environmental damages. This amount can be expressed as the mass of the substance introduced in relation to the mass or the volume of receiving means of the same and can be moderate are the analyzer of size of particles. The particle size is not very excellent for the measurement of the contamination, but the number of them who appear in the atmosphere, which will be able to perfectly measure it with the analyzer of size of particles. The gaseous parts of the contamination are constituted by the combustion of petroleum and the fuel burning fire like the gasoline, sweepings and remainders of plants and animal. With the analyzer of size of particles it will be able to determine the number of polluting particles in the air and thus to be able to determine the damage level that can produce that air, since to major polluting number of dust particles and other substances greater contamination will exist. These polluting particles can bring about respiratory and digestive diseases. Therefore it is very important for the control of the quality of the air to have analyzer of size of particles to be able to determine gravity and origin of these. If besides this analyzer of size of particles it needed an equipment able to detect several types of gases to control the contamination it can see it here: detector multigas. Calibration: Control of the correction of the magnitudes of measurement of the analyzer of size of measurement particles, without intervention in the measurement system. Or: determination of the systematic deviation of the indicator with respect to the real value of the magnitude of measurement. Document or certificate of calibration: it documents to the technical properties of the analyzer of size of particles of corresponding measurement as well as the capacity to restore forces and assets and control damage of the landlord of national measurement. Interval of calibration: In order to be able to realise a lasting correct measurement, the analyzer of size of measurement particles must control itself or calibrate itself periodically. This period of time calibration interval is called. It is not possible to be determined accurately when they are due to recalibrate the analyzer of size of particles. In order to be able to determine the interval it is necessary to consider the following key points: • Magnitude of measurement and band of tolerance allowed of the analyzer of size of particles • Yield of the measuring instruments of the analyzer of size of particles • Frequency of use of the analyzer of size of particles • Environmental conditions of the analyzer of size of particles • Stability of the previous calibrations of the analyzer of size of particles • Precision of measurement required of the analyzer of size of particles • Determinations of the system of quality assurance of the companies. This means that he is the same user is the one that must determine and control the interval between two calibrations.

9.0 DEVELOPMENT OF THE ELEMENTS OF THE PLATFORM

A GIS (SIG or 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 solving complex problems of planning and management.

The SIG works as a data base with geographic information (alphanumeric data) that is associated 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.

The interface webgis can be accessed 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.

![Screen of the geoclimatic Platform](image)

**Fig. 6: Screen of the geoclimatic platform**

### 10.0 CAPACITY OF THE SYSTEM

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 (APPLICATION 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.

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. 

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.

Fig. 9: System of Web FIRE to mapper of satellite Modis.

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

Fig. 10: 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.
12.0 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."

12.1 MAP ELEMENTS

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.

12.2 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:

12.3 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.
Fig. 11: Creating new map 1

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

12.4 BOOOT 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 setCenter ( ) 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.

13.0 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.

14.0 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 database.
b) Discrimination Infrared Bands of the images
c) Digital processing of images

15.0 A NEURONAL NETWORK

A Neuronal Network is basically a 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.

![Fig. 12: Control system fed back of the neuronal network](image)

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 non-linear, 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.

16.0 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 Adder 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.
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.

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.
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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