Web system for the control of the forest fire process in eastern Michoacán

Sistema web para el control de proceso de incendios forestales en el oriente de Michoacán

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Abstract

During the last decade, web mapping systems or geographic information systems have had a great advance in development, being widely used today, this project shows the main elements for achieving the objective of generating a geographic information system for the organization and Fire registry management, which facilitates all of its management processes for the fire command centers in the Eastern region of Michoacán. Web mapping systems have become easier to use by having data management compatibility with normal database managers and/or spatial data and expanding its use in various platforms such as mobile applications. In the development, the implementation of open source maps prevails, obtaining geospatial data, registration and user permissions, drawing and modification of polygons, consultation for documentation of preliminary reports and editing of final reports, with future growth, since with this system, it is possible to have better control and quick management of action on the areas affected by fires, as well as saving time and better management of resources by the different companies associated with this project.

Geospatial, Generator, Facilitates management

Resumen

Durante la última década, los sistemas de mapeo web o sistemas de información geográfica han tenido un gran avance de desarrollo siendo muy utilizadas actualmente, éste proyecto muestra los elementos principales elementos para el logro del objetivo de generar un sistema de información geográfica para la organización y gestión de registro de los incendios, mismo que facilitan a los centros de mando contra incendios de la región Oriente de Michoacán todo sus procesos de gestión. Los sistemas de mapeo web se han hecho más fáciles de utilizar teniendo compatibilidad del manejo de datos con gestores de bases de datos normales y/o datos espaciales y amplian-do su uso en diversas plataformas tales como son las aplicaciones móviles. En el desarrollo impera la imple-mentación de mapas de código abierto, obtención de datos geoespaciales, registro y permisos de usuario, tra-zado y modificación de polígonos, consulta para docu-mentación de reportes preliminares y edición de reportes finales, con un crecimiento futuro, ya que con este siste-ma se puede tener un mejor control y rápido manejo de acción sobre las áreas afectadas por incendios, así como el ahorro de tiempo y mejor manejo de recursos por parte de las distintas empresas asociadas a este proyecto.

Geoespacial, Generador, Facilita la gestión

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Introduction

Nowadays forest fires are more frequent and have affected a large part of the protected natural reserves, so organisations dedicated to the conservation of the environment are looking for technological options that help them to visualise the magnitude of the affected areas in order to make a better distribution of resources and put out the fires that sometimes, due to the type of scenario, are difficult for fire control teams, affecting not only the flora, wildlife and sometimes even human life. Forest fire is a term used to define an uncontrolled fire that spreads, spreads freely and also consumes the different types of combustible materials existing in the forest. A forest fire is impacted by climatic conditions such as fuel moisture, wind speed, air temperature, among others [1]. Some organisations dedicated to the care of the environment and the environment are concerned about the impact of wildfires.

Some organisations dedicated to the care of the environment keep records of these natural disasters in documents that are created manually with the data collected from the affected area, making this an arduous task of obtaining information, because it is difficult to know the exact area in which the fire is occurring and it takes too long to make the records to attend and take action on it in an effective way.

Based on the above, it is considered of utmost importance to develop a web system for the control of forest fire management processes that are generated in the eastern zone, which Biocenosis A. C Zona Monarca, an organisation committed to the environment, as well as Fondo Monarca, intend to take immediate action on the management of fires knowing exactly where the fire is taking place and thus obtain information more quickly in order to speed up the report and have better control over the resources that will be used during the process of action on the disaster.

Answering the question, what are the deficiencies in the management and protection against forest fires in the eastern part of Michoacán, Mexico? This will allow us to have a clear objective to generate a geographic information system for the organisation and management of the registration of fires and to generate a report with the information obtained [2].

Methodology to be developed

The method to be used is in phases.

Phase 1. Fire detection is an important part of an effective fire management programme. It can be done in a variety of ways: with satellite imagery, fire observation towers, aerial surveillance and lightning detection systems, or fire monitoring and reporting by local people. When local residents understand the risk and damage of serious unwanted fires and participate in a community-based fire management programme, they are a very effective part of the overall system.

Once fires are detected, effective communications are needed to provide fire fighters and managers with information on the location, size and condition of the fire. Media dispatch centres, equipped to operate from auxiliary power sources, receive information on fire outbreaks and locations, alert firefighting personnel and dispatch them to individual fires. Dispatchers provide regular communications to the fighters on changes in weather forecasts, fire behaviour, strategy and emergency management structure.[3] The fire managers are also responsible for the fire management structure.

Phase 2. Efficient fire management involves various mechanisms that facilitate the development of the planning, programming, direction, execution and control processes of the projects. The management mechanisms for fire management are designed to maximise the functioning of the established organisation. They approach fire management from different points of view, in a coordinated manner, in order to clarify and order the various activities.

The most important management mechanisms for the implementation of the Fire Management Programme are: Plan System, Organisational Scheme, Instruction System and Information System. The plan system is the one used by the commune; from it, the development plans, operational plans, special plans and property plans are differentiated.

Phase 3. Design. Visualising active fires on the map: obtaining the location, information and images of the fire in order to plot them on the map: Creation of affected area polygons; Display of polygons; Assignment of permits by users; Update of fire traffic light; Registration of fire assignments.

Fire date control: registration of start, action and end dates of the fire; Types of views; Measurement tool.

The relevant framework is scrum: it is simple in itself. The rules, artefacts, events and functions are easy to understand. Its semi-prescriptive approach actually helps to eliminate ambiguities in the development process:

−   Sprint 1: Creation of the user interface: Handling of the main user menu with the use of the different protected areas and the login.

−   Sprint 2: Insertion of the main map and layer types: implementation of the main layer showing the map and its different types of layers or terrains.

−   Sprint 3: Creation of the database: design of the entity-relationship model of the database and implementation in the database and implementation within the online web system.

−   Sprint 4: Obtaining selected data for graphical sampling: insertion, modification and deletion of the different types of geospatial data to be displayed graphically on the map.

−   Sprint 5: Creation of measurements necessary for polygon sampling and measurements: obtaining locations for the plotting of distance, perimeter and area of the polygon and saving in a single data type all the attributes that build it for later handling within the base to be manipulated and displayed graphically.

Phase 4. Development. For the development of the web system for the control of biocenosis processes in the Monarca area, we took into account the needs of the client and the general aspects of management systems such as: leaflet, JQuery, Ajax, MySql, JavaScript, PHP, CSS, Bootsrap and Scrum.

Phase 5. Testing. The system will be in the testing and implementation phase in the second half of 2023.

Results

Functionality. On the main screen of the system, you can see the global map with the location of the fires of the fires.

Figure 1 Initial screen of the web system

The design of the main page shown in figure 1, was generated following the specifications and comments of the organisations involved, also taking into account the needs that they had for the problematic of this one with the intention of having an easy understanding and handling of the system.

Figure 2 Login

Pressing the button in figure 2 opens a floating window for entering the user name and password.

Acknowledgement

Conclusions

The final result of this early warning system project was satisfactory, fulfilling the expectations, since the deficiencies in the management and protection against forest fires in the eastern zone of Michoacan, Mexico were identified, for which a tool such as geographic information systems was used, which facilitates the processes in an efficient way in decision-making, since it allows to collect, store, process and visualise geographic information through simple elements such as: points, lines and polygons that together represent geographic entities and measurable and geo-referenced spatial variables. This technology made it easier to meet the characteristics requested and to surpass them before the organisations. The system was developed with future growth in mind, since with this system it is possible to have a better control and quicker management of action on the areas affected by fires, as well as saving time and better management of resources by the different companies associated with this project.

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