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SOCIAL APPLICATIONS OF THE SPACE TECHNOLOGY IN TABASCO MEXICO

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Abstract

Mexico is a country of socioeconomic divergences, Human Development Report figures vary from 0.830 in Mexico City to 0.667 in the state of Chiapas. Furthermore, the inequality condition of the country is a serious concern: 22% of the population is ranked above an HDR of 0.760, 30.3% goes from 0.742 to 0.765, 14.9% between 0.723 and 0.742 and an unfortunate 32.5% corresponds to the lowest level; oscillating between 0.667 to 0.720 including the states of Chiapas, Oaxaca and Guerrero. It has been reported that around 50% of the population is under socioeconomic disadvantage conditions. There are currently initiatives to improve the development indicators of the country. Two main detonators have been considered to accomplish this challenging task: education and promoting a long, healthy and comfortable life. We argue that outer space has the potential to become a significant vehicle contributing to improve the development condition of the country. Applications such as remote sensing, disaster management, tele-epidemiology platforms, alert systems for civil protection and chemical threats and other meteorological, ecological instances play a crucial role as drivers to improving the quality of life of Mexican citizens. Our proposal consists of the following initiatives: a) Development of free software platforms for comparing satellite images regarding remote sensing, floods, fire mitigation, water pollution and urban and rural mobility patterns; b) Use of Geographical Information Systems [GIS] and data analytics; c) Development of an Electrocardiogram [EKG] prototype with Tele-Health capabilities for diagnosis of cardiac alterations resulting from Chagas disease; d) Development of a Tele-Epidemiology project for health warning and detection in high risk areas affected by Dengue, Chikungunya, Chagas and Leishmania. This initiative includes Tele-diagnostics and mobile health capabilities; e) Development of a program for Health Distance Education in rural areas focused on prevention, diagnosis, and treatment of vector borne diseases; f) Integration and adaptation of Open Source Health Information Systems for epidemiology data processing, statistical analysis and georeferencing; g) Integrate a working group as part of an ecosystem that includes medical specialists and information technology experts.

Keywords: Teleepidemiology, Remote Sensing, Satellite, Telemedicine, Geographic Information System [GIS], Health Information System [HIS]

1. Introduction

Tabasco State is a reference national and international by different reasons that go from his prodigious nature, abundant resources natural as the oil and the water, until them problems derived of a

great disparity social, cultural, educational and of health, as well as its situation geological, hydrometeorological, risks chemical, ecological, health etc. that give as result, lack of attention medical, inefficient programs of preventive medicine, very

large risks to the population before the flood, movement of the ground, pests, and other calamities.

A modern to support State and feasible solution is to work with installed telecommunications infrastructure and tools of space technology such as remote sensing images, satellite communications, use of databases etc. for providing integrated services of e-Health, education and civil protection to the most destitute populations.

E-Health program would provide telediagnosis from the medical units of lower power operative its units of reference,

Whereas the technological capabilities offered by communications satellite, and the use of remote sensing images, coupled with the TIC's, proposed a comprehensive model to apply both the developments in telecommunications, electronics, software, databases, such as images of remote sensing, for prevention of risks most significant in the State, and which can be extrapolated to other sites with conditions of poverty that preclude them from transfers and directly impacts on its economy and in the of the Government

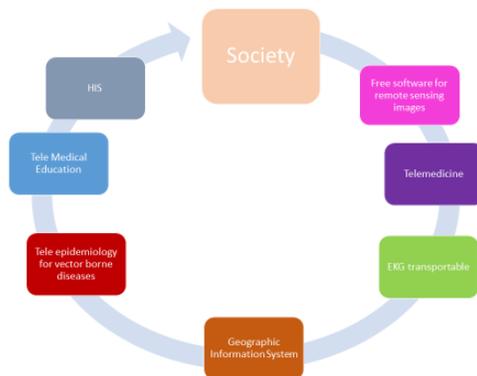


Fig 1 Social Circle to use of Space Technology at the Health

FREE SOFTWARE FOR IMAGE REMOTE SENSING COMPARRING

A model for comparing images corresponding to some areas of interest has been developed based on open platform and free software. The images are taken by satellite of remote sensing. The model compares patterns and the use of visible bands and near infrared, identified in a historical acerbic, variations that had the landscape, particularly

focusing flood, fire shift agricultural land use and modification of the urban and rural.

TELEMEDICINE

the platform used for the Diagnostics and communication medical to medical and medical to patient, was from a principle which is had in the community pilot, and were them links of a program of the Ministry of communications and transport of Mexico that is called MEXICO CONECTADO (Mexico connected) is a project of the Government of the Republic that contributes to ensure the right constitutional of access to the service of Internet of band wide (article 6th. Constitutional).

To achieve said objective, Mexico connected deploys networks of telecommunications that provide connectivity in them sites and spaces public such as schools, centers of health, libraries, centers community or parks, in those three areas of Government: federal, State and municipal.

Through the project Mexico connected each time more students and teachers have access to the band wide in their school or University; more and more doctors and health officials have connectivity in your clinic or health center, and increasingly more citizens enjoy free Internet access in public space, like somewhere, libraries or community centers. [2] Jonuta Health Center, there is a unity of Mexico connected which allows communication with the hospital of reference and we use it to carry out consultations and Diagnostics using also the EKG designed for such purposes

ELECTROCARDIOGRAM

It developed 12-lead EKG, with portability, robustness and easy handling, with recording functions and capability for file sending network in telemedicine applications. Fig 2,3 The EKG via USB connects to any Computer using Windows operating system pre-installed software under EKG. Several electrocardiograms were performed to test the efficiency of the device and 99 % of cases was successful taking electrocardiograms. We record database of people who have characteristics of Chagas disease for analysis [5]



Fig 2 the EKG in portable platform

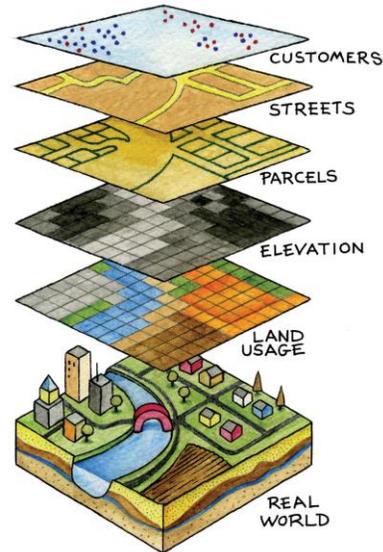


Fig 4 Different levels to remote sensing



Fig 3 Application of the EKG

GEOMEDICINE GIS

The communications satellite, and the use of remote sensing images, coupled with the TIC's, proposed a comprehensive model to apply both the developments in telecommunications, electronics, software, databases, such as images of remote sensing, for prevention of risks most significant in the State, and which can be extrapolated to other sites with conditions of poverty that preclude them from transfers and directly impacts on its economy and in the of the Governmmen [6],[7] [8], Fig 4

TELE-EPIDEMIOLOGY

Vector-borne diseases, most are considered by the World Health Organization as a Neglected Tropical Disease [NTD], as a hidden event and but for us it is an area of opportunity.[2], [3],[4]

For the project the model CHAGAS began, because of all those studied, it is the most refuses, so for which no drug in Mexico, there is also a strong problem academically and it is not known diagnose disease.

There are 8 million patients infected with Chagas reported in the blood bank. Problems because there is evidence that 98% of doctors do not know how to diagnose the disease very high probability of presenting: dilated cardiomyopathy, megaesophagus, megacolon, megaileon.

It is the objective:

- Identify peripherals they can be used for remote diagnosis;
- Understand the link characteristics required;
- Know the availability of diagnostic laboratories;
- Develop Satellite images and software for biomedical signals;
- Determine the applicable regulations;

- Working with local health authorities both pilot site, as State and Federal level;
- Perform a diagnosis Wildlife pilot site and expected changes according to temperature, humidity, population stain etc.

The use of telecommunication via satellite to link the different level of attention of medical in rural areas to Urban area to provide a second opinion, and tele diagnosis and - in special when the meteorological problems stopped the travel to the cities, by example in Tabasco raining many day by months and be floods the ways.

TELEMEDICAL EDUCATION

To the make them tests pilot is install the lack of training of them medical and personal of health in them themes of Chagas and diseases emerging, by what in addition to take advantage of the platform of telemedicine installed, is began to structure a program of education to distance for it training in line

HIS-TELEPIDEMIOLOGICA INFORMATION INTEGRATED SYSTEM.

This comprehensive system has the aim of effectively and efficiently manage the information collected and processed for epidemiological data on health. [9] [10]

This system acts of form similar to a Data warehouse, where the process of storage can be made both of way online, offline [this due to the complex areas where is will act and will collect the information], likewise, has the potential of process data statistical, generate several types of reports, build and handle indicators of health, determine the access to the information by levels hierarchical display and organize information through Control Panel [control panels], georeferencing of the areas where you have more incidence, among many options. Fig 5

The system has the ability to adapt according to the areas of action caring for that information is scalable and measurable using data Fig 6

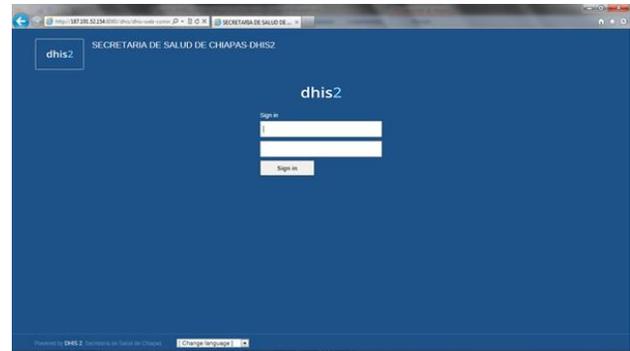


Fig 5 The Interface of Software dhis2



Fig 6 Localization of the sites

Integration of the medical community to the use of TICs in the state

SOCIETY

The direct intervention of society of the sites that have served as a model for this project, make that each of the phases are adapted to the culture of the community, given that works with rural communities as it is the case of Jonuta Tabasco, and urban communities as it is the State capital, Villahermosa, with further references Hospital. By the responses of medical, nurses, patients and training have given precision to them results

2. Material and methods

We used satellite Landsat 8 images, which were analyzed for a period of 10 years, in the area of Tabasco flooding and vegetation patterns were compared, was sampled in the presence of the bug Chagas disease field, related to increases in temperature, through the geographic information existing in the region, and will use the EKG developed by the Polytechnic University of Chiapas, to transmit them electro testing, used platforms of Internet with camera and speeds of 2 Mbps minimum, for transmission of them data and them videoconferences among them medical of populations

rural and urban, is stored and ordered the information in the platform HIS. [11]

4. Results and Discussion

150 electrocardiograms were taken, which were transmitted via internet platform and diagnosed in Guadalajara, at distance of over 1000 km, detecting 43 suspected cases requiring confirmation test in Lab Is identified and geoposition the area of work in Jonuta Tabasco, placing before them analysis historical, that that area had a great probability of be isolated more than the 46% of them days of the year, by what was prevailing that counted with a platform of telemedicine, of equal way the incidence of Chagas, Dengue, Chicomungua and Zika, is has seen increased in them last 5 years due to the change of them rivers Grijalva and Usumacinta , which was their cause, with the consequence and damage to the type of vector that develops around the area wetlands, mangrove swamps, were taken EKGs to patients with suspected of having the disease of Chagas, and it now has the hospital registry pilot population health and environmental conditions.

It is by addressing the tele-education to patients as a medical for the better management of diseases such as Chagas disease and emerging.

The company is now much more identified with the advantages of using telemedicine platforms and medical epidemiologists are developing new protocols of care incorporating the transdisciplinary proposal. Fig 7

The incorporation of the group after disciplinarian, has great advantages since it has been able to work in parallel, to finally integrate the different stages, created the software image comparison of satellite remote sensing, they have been identified risk areas floods in Tabasco, but also has been detected in areas with high probability of presence of the bug Chagas, which were found at the site, allowing advance warning vector presence, likewise have integrated GIS data platforms HIS. Fig 8



Fig 7



Fig 8

6. Conclusions

This identification was obtained by having detected from remote sensing images possible risk area, by adding this field studies and diagnostic confirmation. All cases were transmitted using telemedicine platform and registered in the hospital HIS database. Finally a tele education course in preparation to enable doctors and health personnel, to identify possible cases of Chagas and refer to them in a timely manner to the health centers, which in the case of Tabasco is the Hospital Dr. Maximino Dorantes.

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