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Website and Mobile Application on Land Use Control through the Interactive Map of the Northern Region of the State of Guerrero for INIFAP

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Abstract

A website was created that has user and administrator sections which will generate fertilization recommendations for corn producers located in the municipalities of the Northern Region of Guerrero state. The source of information was provided by the National Institute of Forestry, Livestock and Agricultural Research (INIFAP initials in Spanish), Experimental Field in Iguala. This source emanates from an agricultural census which is a printed document which describes data such as: land owner's name, municipality, town, slope, length, latitude, crop type, source and quantity in kilograms of fertilizer based on the type of PH of the soil: if it is less than 7.5 it will be phosphonitrate and if it is higher than 7.5 it will be ammonium sulphate with its respective source of phosphorus (DAP), from each corn producer in every municipality and town belonging to the Northern region of Guerrero through an interactive map. A mobile application was also carried out which will show information about the INIFAP, and will also provide specific data on the corn sowing plots sampled in each municipality of the Northern Region of the State of Guerrero, such as: predominant climate, agricultural areas, soil types and researchers in INIFAP.

PH, DAP, INIFAP

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1. Introduction

This work is based on the project of professional practice made by three students of the educational program of Engineering in Information Technologies at the Universidad Tecnológica de la Región Norte de Guerrero, the document they presented is a report of those practices that helped them obtain a bachelor degree in the program.

This report was later restructured as a thesis as part of the research project carried out at the National Institute of Forestry, Livestock and Agricultural Research of the State of Guerrero, to obtain the fertilizer treatment called technological package of fertilization of the land of sow for corn producers in the Northern Region of Guerrero through the application of a chemical formula located in three tables attached to this work.

1.1 Justification

INIFAP has an agricultural census which has information on the sowing lands which belong to corn producers from different agricultural areas in the State of Guerrero. These lands are both rainfed and irrigated farming. The construction of the technological fertilization package is done manually searching the information in a printed document, a process that is tedious, whenever it is required to calculate such technological package.

Therefore it is necessary to develop and implement a website and a mobile application for the control of land use through an interactive map which in a first phase will only contemplate the Northern region of Guerrero, and obtain the construction of the technological package of fertilization depending on the agricultural area, thus allowing faster decision making according to the criteria required such as: soil PH, soil type, number of hectares, type of fertilization to be used, among other data.

1.2 Problem

INIFAP is an Institution of scientific and technological excellence with leadership and national and international recognition for its capacity to respond to the demands of knowledge and technological innovations for the benefit of agriculture, livestock and society in general [2]. It is focused on the development of different projects for the improvement and crop fields by carrying out records of PH of the soil, total area of the land to be planted and the total of fertilizer to be used based on an agricultural census of land use on the sowing lands specifically; corn.

Because of the conditions of each crop field are very diverse, some criteria is applied to build the technological package of fertilization. Such information is found in a printed document and only has some samples of the crop fields from corn producers in each municipality and town from the State of Guerrero.

In order to calculate the fertilization treatment, it is necessary to review the agricultural census and, depending on the information, a chemical formula is applied (see the section on annexes for the fertilization section on tables 2, 3 and 4) where the elements that will serve to determine the amount of fertilizer will be used are found and according to the degree of acidity in the PH of the soil the type of fertilizar to be used will be determined.

All this is done manually every time it is required which makes the treatment process tedious and slow; thus creating a bad effect over operability and decision making to know the quantity in kilograms and the type of fertilizer for every specific sowing land.

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1.3 Hypothesis

With the construction of the technological package of fertilization website and mobile application, it will be possible to obtain the source and the exact dose of fertilizer to be applied in the crop lands belonging to corn producers located in the Northern region of the State of Guerrero.

1.4 Objetives

1.4.1 General Objective

To develop and implement a website and a mobile application on land use control through the interactive map of the Northern Region of the State of Guerrero, with the purpose of informing the producers the source and dose of fertilizer to apply in their lands of corn sowing.

1.4.2 Specific Objetives

- To construct the database with the name of inifapbd that includes the tables, such as: Users, Identification, PhysicalFeatures, ChemicalStructure, SoilUse, Crops, States, Municipalities and Localities, through the MySQL database manager.
- To design web site graphical interfaces for user interaction such as web forms through Dreamweaver and Sublime Text 3.
- To build user, search, delete and update modules.
- To deploy security level through User and Adminstrator roles.
- To use programming languages such as: PHP, JavaScript, HTML, Apache Córdoba, Android SDK and IONIC.
- To generate information over the source and dose fertilizer for sowing land belonging to each municipality and town in the Northern region of Guerrero.
- To generate a fertilization report for corn producers in the Northern region of the State of Guerrero through a PDF document for consultation and printing.
- To build the appropriate mobile application for the website to provide information to producers in the Northern region of the State of Guerrero.

3.1 Type of Research

To contextualize our prototypes of website and mobile application, it is located in the area of applied research as a technology transference since it solves the problem of the amount of fertilizer to be occupied in the field of sowing by corn producers in the Northern Region Of Guerrero, starting from the degree of acidity of the soil PH, using a chemical formula that is found on the three tables that are in the category of annexes in the section of fertilization of each table regardless the level of productivity whether it is high, medium, or low (See Annexes, Tables 2, 3 and 4), and contains the elements that allow calculating the amount of fertilizer in kilograms and the type of fertilizer to be applied to the land.

3.2 Theorical Methods

In order to carry out the present research project between the INIFAP and the Universidad Tecnológica through the academic corpus UTRNG-CA-8 it was necessary to analize a similar program that is being carried out bythe technological fertilization package for corn sowing land in the State of Morelos. This software is named Fertilization System for the State of Morelos [1], but has limited information in the agricultural census of the municipalities and towns of Morelos and because it did not have continuity in its development nor operation as a computer software, it remained in the obsolescence for the staff who built it could no longer continue to improve it.

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Due to the information above and the fact that the State of Guerrero does not have a technological tool that can automatically obtain the treatment of fertilization based on the agricultural census motivated INFAP researchers, professors of the academic corpus UTRNG-CA-8 of the Universidad Technológica, and students of the Information Technology Engineering to support as collaborators to develop the prototype of website and mobile application that would allow to obtain the technological treatment of fertilization for the crop fields especially of corn located in the Northern region of Guerrero in a first phase.

3.4 Software Development Methodology

Software has become the key element in the evolution of computer-based systems and products, as well as one of the most important technologies in the world. Currently the software evolves according to a set of laws that have remained unchanged over 30 years. The purpose of software engineering is to provide a general framework to build software with higher standars of quality. [5]

For the construction of the website and the mobile application, a software-engineering-based for the development of software methodology was used; cascade or classic model. The activities are described according to the stages in which this methodology is integrated as follows:

Stage	Description
Collection of Information	In this first phase, interviews are conducted to collect the necessary information to develop the website and mobile application for the INIFAP.
Analysis	At this stage all the information collected through interviews and visits to Dr. David H. Noriega Cantú, a researcher of fruit trees and agricultural health, was analyzed. The information collected will be processed and will serve as the basis for the design.
Design	The architecture obtained through the analysis will be molded to create the design and development of the website and mobile application in a simple and understandable way for INIFAP staff as it will serve as the basis for implementation.
Implementation	The programming of the website and mobile application will be carried out using the software Dreamweaver, Sublime Text 3, Apache Cordova, Android SDK and Ionic. The encoding, compilation and implementation begins.
Testing	The website and mobile application are tested once the prototypes are finished, in order to discard all kinds of failure while operating.
Documentation	In this stage all relevant information that is emerging in the realization of the website and mobile application will be documented to support the administrator and users of the website.

Table 1 Stages of software development methodology.

4. Results

The results obtained in this first phase of the project are two prototypes: one is a website and the other a mobile application, which are described below. From the website a main menu can be displayed with the corresponding options according to the login profile either as a user or an administrator, as it is seen on figure 1 and 2 respectively.

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Figure 1 Normal User View of the Options Menu.

Figure 2 Administrator View of the Options Menu.

The Map option shows the States of the Mexican Republic; then if you click on the State of Guerrero, its regions are shown; then the municipalities until you reach the level of towns from each municipality of the Northern region of Guerrero, as shown In Figures 3, 4 and 5 respectively.

Figure 3 Map of the Mexican Republic.

Figure 4 Map of Guerrero state.

We can see the towns that belong to the municipality of Cocula, Guerrero. One of those towns, Apipilulco, is chosen as an example to obtain the fertilization technological package according to some corn sowing land.

For this calculation criteria such as PH, slope, length, latitude, and type of crop are also taken. At the same time it is possible to see its source of fertilizer as well as the amount in kilograms depending on the PH degree of the soil; if it is lower than 7.5, it will be phosphonitrate; yet, if it is higher than 7.5, it will be ammonium sulphate with its respective phosphorus source (DAP); thus obtaining both the amount in kilograms as well as the type of fertilizer required by the land to be planted.

5. Conclusions

Subsequently, in a first phase of the collaboration project between INIFAP and UTRNG significant progress was made, which is described below:

– A database was created under the name of inifapbd that includes the following tables: Users, Identification, Physical Characteristics, Chemical Structure, LandUse, Crop, States, Municipalities and Towns, through MySQL

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- The graphic interfaces for the WebSite were designed as web forms for interaction with users, through Dreamweaver and Sublime Text 3.

- User, Search, Delete, and Update modules were built.

- The level of security was constructed through roles, such as: administrator and user.

- Programming Langusges such as: PHP, JavaScript, HTML, Apache Córdoba, Android SDK e IONIC were used.

- The Fertilizer Technological Package was generated for corn crop fields from every municipality and town in the Northern region of Guerrero.

What is intented to be developed on a second phase of the project will be explained through the following recommendations and further works:

- To host the Web system in a hosting under a sub domain from the main domain of INIFAP or that it is subcontracted by a third party to the Intitution.

- To update the records of the crop lands, and its owners to cover one hundred percent the agricultural census for each and every one of the regions in Guerrero State.

- To debug the algorithm that performs by mean of a chemical formula the calculos of fertilization in the corn crop fields so that the endowment of the packages per kilogram would precise for each landowner.

- To build more modules on the WebSite to cover other type of crops such as: jamaica, peanut, sorghum, etc.

- To perform another agricultural census with the porpuse of updating the current one that goes back to 1998.

- To provide the mobile application with remote data access so researches can be able to send and receive information based on the implementation of new modules in order to make the information processing more efficient depending on the event.

6. References

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