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The information and communication technologies in the administration of the processes and systematization

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Abstract. The objective of the research is to describe how Information and Communication Technologies allow not only to organize in the strain bank microorganisms obtained from different environments for application in academic, research and extension processes, but also to continue characterizing microorganisms obtained from different environments for application in all these processes. Results it has been observed that the absence of Information and Communication Technologies as a strategy to organize and select viable microorganisms already identified can continue to be used and applied in industrial processes, environmental, agricultural food and pharmaceutical industry, among others, has caused the dispersion and loss of information, hindering the easy and timely recovery of the products generated, not being recorded and stored information that is generated. The “Laboratorio de Investigaciones en Microbiología Avanzada y Biología Aplicada” must create its own website and web application that allows strengthening the strain bank, allowing them to be visible with the production generated there.

1. Introduction

This article describes the specification corresponding to the business model and domain associated to the project "Phenotypic and molecular characterization of microorganisms obtained from different environments for application in academic, research and extension processes and their organization through the use of Information Technology (IT) in the “Laboratorio de Investigaciones en Microbiología Avanzada” of the University” in alliance between the “Grupo de Investigación y Desarrollo de Ingeniería de Software” and “Grupo de Investigación en Ciencias Biológicas” of the “Universidad Francisco de Paula Santander” [1]. The objective is to determine macroscopically, microscopically and molecularly the microorganisms obtained from different environments for their application in academic, research and extension processes. For this, their organization and systematization is done through the use of Information Technology in the “Laboratorio de Investigaciones en Microbiología Avanzada” of the “Universidad Francisco de Paula Santander”.

2. Modeling the business

Business modeling is defined as the process of representing various aspects and fundamental elements of an organization, such as its purpose [2], structure, functionality, logic and components. The organization of the business model is divided into 4 parts: the description of the business model that



includes its definition and objectives; the modeling of business processes with their respective diagrams; the business actors classified hierarchically according to their role and finally the business rules. To guide the reader, it is necessary to know which processes are carried out in the “Laboratorio de Investigaciones en Microbiología Avanzada y Biología Aplicada (MAJUMBA)” and from this, to focus the software engineering work to be carried out for the construction of the proposed “MAJUMBA” web system where communication technologies plays an important role supporting the work of its researchers.

On the other hand, the domain model is an analysis artifact based on the rules of the unified modeling language whose function is to describe the different entities, their attributes, roles and relationships, in addition to the restrictions that govern the domain of the problem [3].

2.1. General description of the business

The identification of microorganisms will allow to contribute to the formative process of the students of biotechnological engineering to acquire skills and abilities in their occupational and professional area such as the presentation of projects that allow the application of what has been acquired in their training processes and are applied in a context such as their academic and research practices. With the above, viable and identified microorganisms can be organized and selected for use and application in industrial, environmental, agricultural processes in the food and pharmaceutical industries, among others.

For institutions it is of vital importance to carry out a control and monitoring of different collections of microorganisms and for this they need to gather and organize numerical data and graphic representations captured in statistical reports which facilitate and improve decision making [4].

2.2. Business modeling of the laboratorio de investigaciones en microbiología avanzada y biología aplicada

The person in charge of the laboratory (in the web administrator system) is the only person responsible for 1. Registering a strain and it is obligatory to assign a code, a microbial group and a genus to the strain in order to be able to be cultivated (framed in the project). The strains must be analyzed in different selective means, which leads to loss of time and a handling of physical documents where these results are registered and decisions are made.

One of the objectives of the laboratory is to promote the culture and monitoring of microbial strains in order to improve decision making with respect to them and automate their monitoring in a faster and more efficient way. To this end, a web system is created to manage the aforementioned, and Figure 1 describes the processes (under business process model notation) [5], which are developed there. Figure 2 describes in detail the project management process, the objective of which is to register and modify the information corresponding to projects by accessing the system through a single access account.

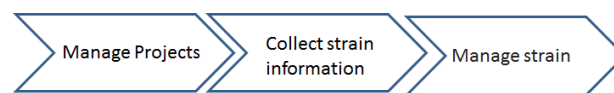


Figure 1. Business Processes.

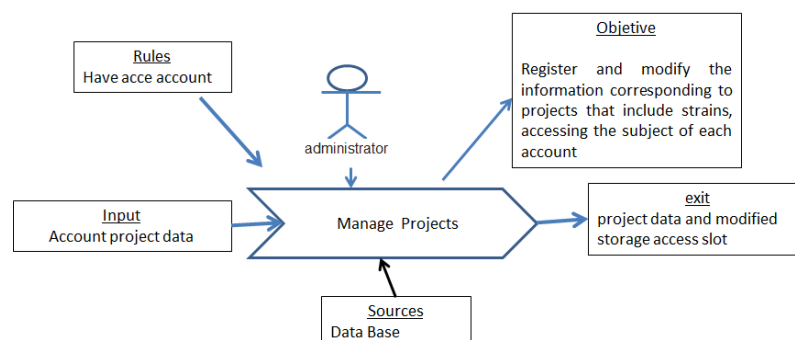


Figure 2. Project management process.

Figure 3 graphically represents the managing strains process, allowing to register and modify the information corresponding to the microbial strains by accessing the system through a single access account.

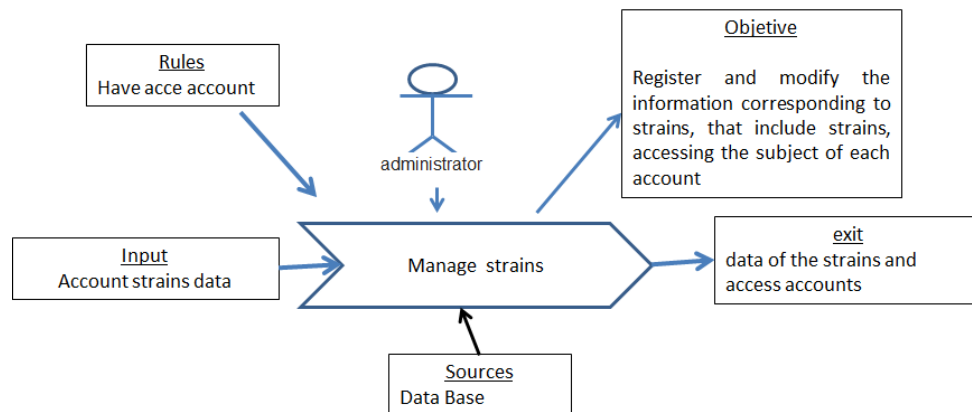


Figure 3. Managing strains process.

Figure 4 depicts the process of collecting results and information for microbial strains by accessing the system through a single access account.

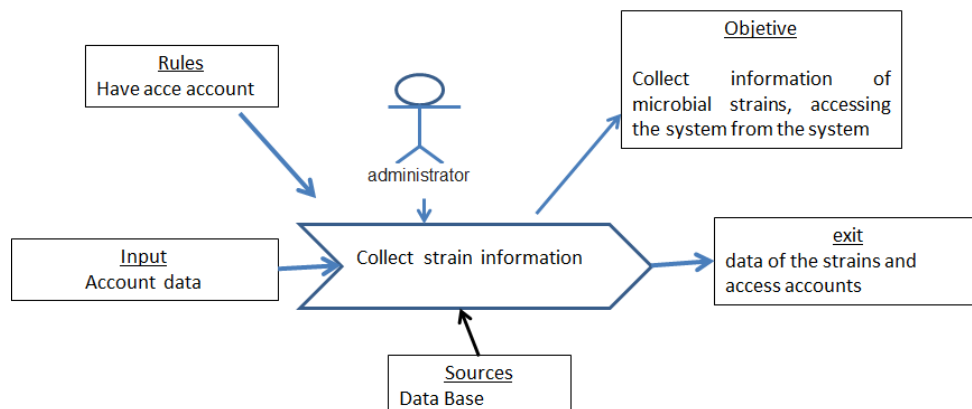


Figure 4. Process for collecting strain information.

Then it is necessary to describe the actors of the business: The user administrator: In charge of registering, consulting and modifying the information concerning the microbial strains and managing the project reports within the software. Researcher: Participates in the access with his account and visualizing the records made of the strains and projects within the “MAJUMBA” research group.

2.3. Business rules for the web system

The system administrator is responsible for managing: researchers, strains, projects, publications, news, activities, items, species, gender, medium, surface, origin, microbial group among other functionalities. Processes that take a large part of the time, since they are carried out manually. As there are no technologies of its own that allow it to better manage and control the projects and strains that are treated there. 2. In case it is required by the administrator to obtain the results of the strains, all the fields must have been validated for their registration and 3. The strains must be analyzed in different selective means so it is required to register these results of edge, consistency, optical detail, shape and surface.

3. System Analysis

3.1. Requirement taking

Next, 75 initial requirements were described that the web system [5,6], is going to develop and of which the system must be able to attend, among them are: allow the administrator to log in, add, delete and consult researchers, register and update strains, register and update projects, register, consult, eliminate activities and novelties, among other requirements developed. It is the responsibility of the system administrator to manage: researchers, strains, projects, publications, news, activities, items, species, genus, medium, surface, origin, microbial group, among other functionalities. Figure 5 describes the cases of use of the web system modulo administration panel and end user module.

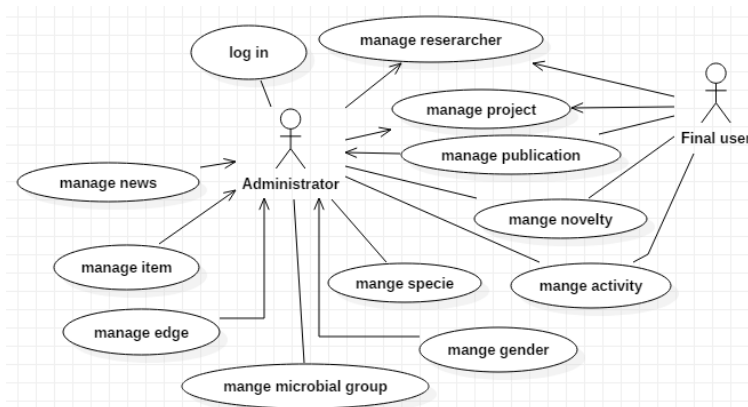


Figure 5. Cases of use of the web system modulo administration panel and end user module.

Once the use cases and their specifications were identified, the respective analysis model is documented with each of the functionalities, the first interface of each functionality, the analysis class model and the initial database model.

4. Systems Design

The purpose is to clearly specify the “MAJUMBA” web software architecture, translating in architectural and design terms all software requirements. This information is addressed to the stakeholders involved in the software development process, as they are: The project manager, requirements analyst, software architect, development director, developers and testers [7]. For the description of the system architecture, there were different important aspects such as:

- View of the use case model, where the use case diagrams are described, including only the use cases relevant to the system architecture.
- Traceability from the use case model to the systems design model, the design objects and subsystems that intervene in the use cases and their relationships were identified (package diagram).
- The view of the design model, showing the decomposition of the design model in subsystems, its interfaces and the dependencies between them [8].
- Traceability from the design model to the implementation model, indicating the traceability between the design entities of the design model and the components of the implementation model [9,10].
- View of the implementation model, where the general structure of the implementation model and the decomposition of the software into modules is described.

- View of the distribution model, describing the physical distribution of the system in terms of how the functionality is distributed among the computational nodes.

4.1. Traceability from the use case model to the design model

Model-view-controller is a software architecture pattern, which separates the data and business logic of an application from the user interface and the module in charge of managing events and communications. For this model-view-controller proposes the construction of three different components that are the model, the view and the controller, *i.e.*, on the one hand defines components for the representation of information, and on the other hand for user interaction. This pattern of software architecture is based on the ideas of code reuse and separation of concepts, features that seek to facilitate the task of developing applications and their subsequent maintenance [11,12].

For the development of the web system to manage the collection of microorganisms belonging to the strains bank of the research group “MAJUMBA” the user interfaces of the information system were designed are simple, easy to navigate, designed to be used by the staff of the microbiology area of the Universidad Francisco de Paula Santander.

They are basically composed of 3 parts: the header that contains a navigation bar with the respective sections of registration, queries, updates and tools; the body (body of the view) where the forms and information are displayed depending on the activity performed by the user and the footer (lower part of the view) that contains the copyright of the application.

4.2. Traceability from the design model to the implementation model

The user, through the computer's web browser, will enter the web application "MAJUMBA" where he will be able to find the modules or subsystems of registers, queries, modifications and statistics of the information of the research group. The application is related to the database through the controllers, see Figure 6.

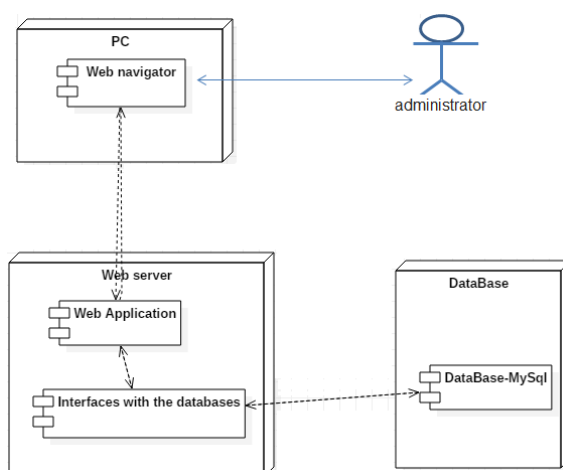


Figure 6. Implementation and distribution model.

5. Results

It was developed the web system to administer the collection of microorganisms belonging to the bank of strains "MAJUMBA", which allows the administration of the processes and systematization of the bank of strains of “Laboratorio de Investigaciones en Microbiología Avanzada” of the “Universidad Francisco de Paula Santander”. Allows to have the relevant information of each microorganism and make decisions. The data bases of the strain bank of the “Laboratorio de Investigaciones en Microbiología Avanzada” were created, optimizing workflows, in pre-analytical studies and susceptibility studies, as well as in the post-analytical.

6. Conclusions

The use of Information and communication technology allows the automation of processes concerning the bank of strains performed in the “Laboratorio de Investigaciones en Microbiología Avanzada y Biología Aplicada”, streamlining the activities and processes that are performed in the different practices of students and researchers who require the use of these microorganisms.

A significant impact is evidenced in the application of technology in the working routines of the laboratory, where Information Technology contributes to improve the missionary processes of the laboratory, give greater organizational agility, improve innovation capabilities.

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